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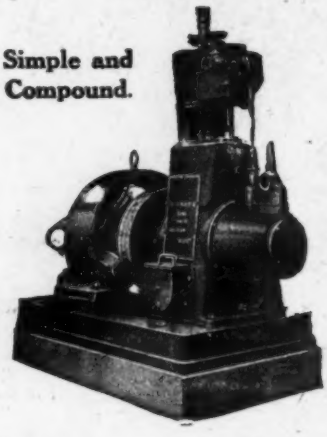

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THE ELECTRICITY SUPPLY BILL: ADDENDUM.

WHEN the Government declared its intention, in December last, of introducing an amending Bill to enact the—shall we say—penal clauses that were omitted from the first version of the Electricity (Supply) Bill of 1919, we doubted whether it would be as good as its word. For one thing, the Act as it stood, shorn of its most controversial features, was acceptable, for what it was worth, to every branch of the industry; true, there were those who desired the compulsory clauses—but there were practically none who objected to the clauses actually passed into law. Further, it seemed to us, and not to us alone, that the unexpected loss of the additional powers would prove a blessing in that it would allow the Commissioners to look round and take stock of the position, and to acquire some experience of the procedure by which they could best attain the desired ends—first, and most important, economy of fuel: secondly, but as a means of attaining the first, the provision of a cheap and abundant supply of electric power to all parts of the country.

However, for once a Parliamentary pledge has been redeemed, and the Bill is before the House of Commons, embodying with but little change the provisions that were struck out by the House of Lords. Its progress will be a thorny one; its re-introduction affords an unhoped-for opportunity of making good the errors of the past session, and no stone will be left unturned by the opponents of the measure to retrieve their losses. The issue is now a plain one, between the representatives of private ownership and communal ownership respectively. The main principle of the original Bill—State Control—has become the law of the realm; but the secondary purpose of some of its promoters—to drive out private enterprise—has not yet been achieved. Why should it be? We have often expressed the view, for which there is abundance of sanction in the success attained in the United States and elsewhere, that private enterprise under State control is the most efficient and progressive method of conducting a great business undertaking such as that of electricity supply, and we adhere to that opinion. The fruits of national ownership are familiar to all observers; amongst the many lessons of the war, that has been one of the most painful to learn and most costly to the individual, who has also learnt that it is most difficult to rid himself of the incubus, once he is in its clutches.

Not only did the original Bill foredoom the private company to extinction, with few and unimportant exceptions; it also proposed to accomplish that achievement by methods which were hardly one step removed from fraud. The terms of purchase of generating stations and main transmission lines were so flagrantly unjust, that even the Government, for very shame, had to provide a partial remedy—but the cure was little better than the disease; the companies were offered the alternatives of staying in the business as distributors, with an utterly inadequate degree of compensation for the loss of their plant, or going out of business altogether in order to secure the return of their capital, at the sacrifice of their goodwill and the opportunity to recoup themselves for their early losses. The fact that they were protected from such an eventuality by a definite agreement with Parliament, which ought to have been regarded as binding upon any Government, is undeniable; they were to have a concession for 42 years, and at the end of it to receive the fair market value—the then value—of their plant, if it were purchased by the local authorities. Their plant is now worth nominally twice its original value,

and to return to them their capital outlay, in terms of the present depreciated currency, is a manœuvre unworthy of any Government. If justice is to be done, a way must be found for the companies to remain in existence on tolerable terms, unless they wish to leave the business; to force them out of it by imposing upon them confiscation terms is robbery.

There are two points, therefore, which to our mind require amendment. The first is the terms of compulsory purchase; this should not be put in force until and unless it is necessary in the interest of economy and progress, but when it is, it should be on the basis of justice and equity. The other item is the price of bulk supply. Under the present Act, the whole benefit of any reduction in the price is to enure to the consumer; it is, however, certain that if the present undertakers were permitted to continue generating electricity and extending their plant, they would be as well able as the District Boards to reduce the generating costs, sharing the benefits with the consumer, and this is included in their rights under the Parliamentary agreement. Under the Act they are deprived of this right, without compensation in any shape.

It is up to the supporters of private enterprise now to see that it is afforded a fair opportunity of justifying its existence, and of entering into voluntary co-operation with other agencies for the purpose of economising fuel and labour. The chance will never recur.

Confidential Communications.

An echo of the Report on the Electric Lamp Industry was heard at the meeting of the Grand Council of the Federation of British Industries, last week, as reported in *The Bulletin*. A letter from the Electric Lamp Manufacturers' Association pointed out that the Committee had published information which was supplied by the manufacturers on the understanding that it would be treated as confidential. A resolution proposed by Mr. D. N. Dunlop, director of the B.E.A.M.A., declaring that the publication was a breach of the Profiteering Act, and was most detrimental to the interests of British industry, was carried unanimously.

While no one will deny that, in the interests of truth, it is essential that the Committees inquiring into questions of profiteering shall be furnished with full information on the points with which they deal, it is no less certain that the unauthorised publication of such data, when obtained under the seal of confidence, is the most effective method imaginable of inducing manufacturers and traders to endeavour in future to withhold them from the Committees. In this case the mischief has been done, but an unmistakable warning has been issued to manufacturers in other branches of industry that they cannot rely upon the integrity, or even the discretion, of such committees, and they will not be slow to learn the lesson. It is absurd that measures intended for the benefit of British industry should thus be turned to the advantage of our foreign competitors by affording them priceless information regarding manufacturing costs and other conditions obtaining in this country.

At the same meeting a resolution was adopted that steps should be taken to ensure the appointment on such committees of members possessing technical qualifications. While we agree that the *personnel* should include some members competent to guide the Committee to correct conclusions, we would not have them all, or even a majority of them, experts in the subject of their inquiry. It would in many cases be exceedingly difficult to constitute a committee of experts that would not be even more objectionable to the industry concerned, and it will be admitted that the specialist, however upright and worthy, is not likely to be able to occupy a position of judicial detachment and impartiality. It is the established practice of the British law courts to submit highly technical patent cases, for example, to a judge who has no personal interest in the subject of dispute, and the results of this procedure have not proved unsatisfactory. It is, however, most desirable that the members of committees should be men of affairs and accustomed to the exercise of judicial functions, which is certainly not the case as a rule.

The Budget and Increase in the Inland Telegraph Rate.

On November 1st, 1915, the Government substituted and brought into force a minimum of 9d. per telegram of 12 words, and ½d. each additional word, for a 6d. minimum which ruled before, an increase of 3d. per telegram. The present Budget proposals provide for a further increase in the rate to 1s. minimum, and 1d. for each additional word, making a 100 per cent. increase over the pre-war rate. No doubt the public have dismissed the subject with the unpleasant reflection that inland telegrams are to cost more, but they probably have not realised the far-reaching effect the increase is likely to have on international telegraph rates. When the increase to 9d. became effective in 1915, cable and telegraph companies maintained their rates, but as they will now have to face a rate that has doubled, it is an open question if they will adopt the same attitude. Working and maintenance expenses have, like those of other concerns, risen enormously, and, notwithstanding the additional burden, rates have not been increased on this account so far. To arrive at a rate from point to point various charges per word and per message have to be added together, and in this way a fixed rate from any place in the United Kingdom can be arrived at to any place abroad. It stands to reason, therefore, that the increased inland rate must affect international rates if it be applied to such traffic, and is not merely local in effect. The Western Union Telegraph Co. has also increased landline rates in North America by 20 per cent., and this increase, in addition to the one proposed here, may well lead to all-round alterations. It may be that the rate, say, from New York to London and any other city to which the cable companies lease their own landlines can be maintained at 1s. per word and the inland rate added to places where the companies have not their own offices, but if, in addition, rentals for leased lines, tubes, &c., are increased to any extent, the 1s.-per-word rate may have to be increased to all places to meet the extra demands of the private and Government landline systems. The mercantile community will, no doubt, have to be prepared for changes.

Temporarily, at all events, the realisation of our hopes for cheaper communication throughout the world may have receded, but we cannot believe that it will be long before it is secured. It is, of course, true that the cost of new cables and working expenses are greatly increased, but wireless will play an important part in the near future. If we limit inter-Colonial communication by high rates, we inevitably limit Empire development and prevent wealth and revenue production.

Compulsory Arbitration in France.

Considerable irritation has been produced in Labour circles in France in consequence of the introduction in the Chamber by M. Jourdain, Minister for Labour, of a Bill which provides for the adoption of compulsory arbitration in order to settle disputes between workmen and their employers. The undertakings affected by the Bill are (1) railways, tramways, and other means of transport in common by land, sea or waterway; (2) gas and electricity works; (3) coal mines; and (4) undertakings for the distribution of water, light and power. Two preliminary stages are provided for under the Bill before reaching the state of compulsory arbitration. In the first place, a deputation of five workmen can wait upon the heads of the works to deal with the dispute; and, secondly, conciliation can be resorted to before a competent committee or before a magistrate. Should both these methods fail to bring about a settlement, compulsory arbitration will come into force, and strikes and lock-outs are suspended. The Bill proposes the imposition of penalties for contraventions of the law. These comprise (1) fines of from 16 to 10,000 fr., and imprisonment from six days to three months; and (2) the requisition by the Government of the buildings, plant, and *personnel* in case one of the parties infringes the regulations.

EXTENSIONS IN THE CLYDE VALLEY POWER STATIONS.

The Clyde Valley Electrical Power Co. has just put on commercial load a large Metropolitan-Vickers turbo-generator set at its Yoker power station. This station is situated on the tidal portion of the River Clyde, and well placed for fuel, water, and distribution; it is illustrated in fig. 3, p. 548.

The new set (fig. 2) is rated at 18,750 K.V.A., giving a normal output of 15,000 KW. at 0·8 power factor. The turbine has Rateau blading with 14 expansion wheels, the casing being of cast-steel for the high-pressure and cast-iron for the low-pressure end. The working steam pressure is 200 lb. per sq. in., with 160° F. superheat, and a special arrangement is provided at the low-pressure end of the turbine for drawing off steam for feed-heating under vacuum, which is estimated to give 5 per cent. additional economy by raising the temperature of the feed water to 155° F. The governor is of the oil relay type, the pump supplying oil at a pressure of 70 lb. per sq. in. The main bearings are lubricated under pressure from a second oil pump, also driven off the main shaft, both pumps drawing from a common tank in the turbine bedplate. The oil is cooled during use by Zimmermann oil coolers.

The alternator generates three-phase current at 11,000 volts, 25 cycles, at a speed of 1,500 R.P.M. The two-pole rotor is machined from a solid forging, and the end windings of the star-connected stator are specially braced to resist lateral stresses. Three air-cooled reactances, giving a reactance value of 5 per cent., are installed. Merz-Price balanced protective gear is fitted to protect the generator. The air for cooling the machine windings is circulated by fans carried on the main shaft and within the generator casing, the air being washed prior to use in a Davidson air washer. Excitation current can be supplied from the direct-coupled exciter on the turbine shaft, or separately from the station D.C. bars.

The cables from the generator to the switchgear gallery are 0·75 sq. in. single-core, lead-covered and armoured, six in all, two to each phase, and arrangements are made on the board for remote control of the main machine switch, as well as of the generator earth switch.

The condenser, situated immediately under the turbine, is of Messrs. Weir's land type, capable of dealing with 200,000 lb. of steam per hour, the normal vacuum carried being 29 in. with barometer at 30 in. The pumps are also by Messrs. Weir, being of their Dual make, electrically-driven through spur gearing from a 40-H.P. three-phase, 25-cycle, 480-R.P.M. induction motor.

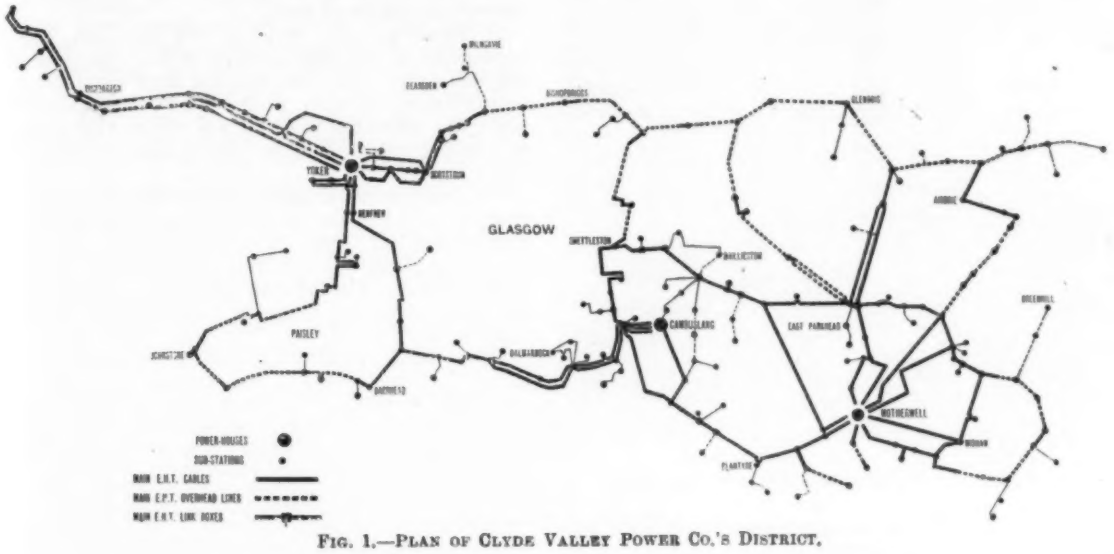


Fig. 1.—Plan of Clyde Valley Power Co.'s District.

The pumping plant at the river intake in the Clyde is common to this set and to the other generators in the station, the whole circulating plant operating into a 42-in. main. Little trouble is experienced with the water screening at the station, the screens used being of the ordinary mesh pattern.

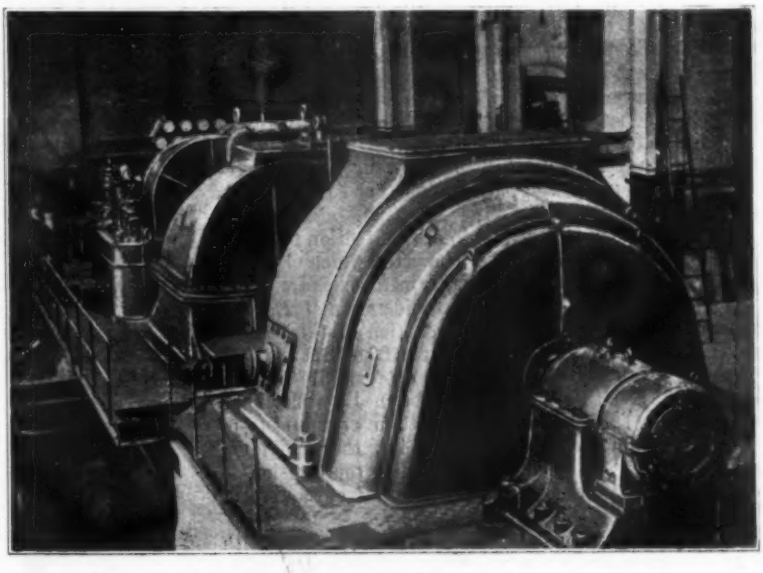


Fig. 2.—Metropolitan-Vickers 18,750-K.V.A. Turbo-Generator.

The set is supplied with steam from the station range of Babcock & Wilcox boilers; the total steaming capacity of the power house is 285,000 lb. with four boilers on induced and eight on natural draught.

A similar turbo-alternator to that described is under construction at the company's Clyde Mill Power Station, Cambuslang, and the installation of a second 15,000-KW. set is under consideration for the Yoker power station.

The company has now three large generating stations in commission, with 180 sub-stations and switch houses, as shown in fig. 1, and its power and lighting business is pro-

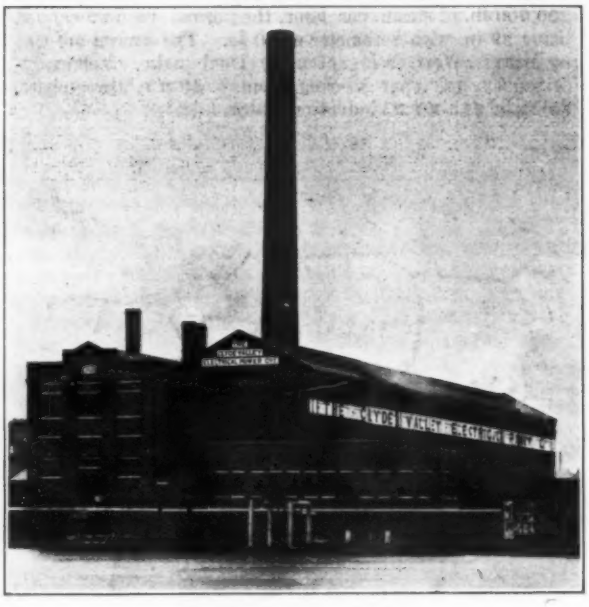


Fig. 3.—Yoker Power Station.

gressing very rapidly, the total contracts for supply at present amounting to 145,000 H.P. We are indebted to the company for the foregoing particulars and illustrations.

LOW-VOLTAGE LIGHTING OF ELECTRICALLY-EQUIPPED FACTORIES.

By C. T. WILKINSON.

It is to be regretted that the electric lighting of factories has not yet received the close attention and study in England which have been accorded it abroad. As a result, the English engineer planning the lighting of an electrically-equipped factory has not at his command the complete regulations and suggestions that are available elsewhere.

The recent report of Mr. Scott Ram on fatal accidents in electrically-equipped factories seems to point in the direction of low-voltage lighting, and, indeed, one such system is therein mentioned.

It is the object of this article to draw attention to a low-voltage lighting system of novel character, which claims to have appreciable advantages over other methods, and which it is thought might be worthy of the consideration of English illuminating engineers. By the adoption of this system low-voltage lighting was first applied to a factory at the time under the direction of the Admiralty. A pressure of 12 volts was selected, and this voltage was obtained by placing a small fine-wire 12-volt coil at the bottom of the slots of the standard induction motors operating the individual machine tools. The conditions governing the decision to use this system in the case of a modern factory were as follows :—

The shops were laid out according to latest practice, with plenty of space between the machines, and with steel tubes carrying the wires in the concrete floor up to each motor. Individual lighting points from above were impossible, as they would have prevented free movement of the overhead cranes, and if the lighting wires were kept entirely separate from the power circuit in the usual way, separate steel tubes for these lighting circuits would have been necessary. Further, the cost for individual lighting points for each machine would have worked out at more than £3 per point.

However, the men to be employed on the machine tools insisted on individual lights, and were backed up in this preference by the technical operating staff and foreman.

Examination of the best intensity allowances available for the different classes of factory work indicates that for this particular work if individual machine lights were used, the general overhead lighting of the shop would require only a fraction of the wattage otherwise necessary, and a great saving was made in this direction, not only in first cost of equipment, but in annual operating charges, this overhead lighting being only such as was necessary to provide sufficient illumination for the safe and speedy movement of overhead cranes carrying material, other shifting of material, and general supervision of work.

If, therefore, while reducing the cost and operating expenses of the overhead lighting, as previously mentioned, the individual lights for machine tools could be put in extraordinarily cheaply, at the same time consuming a negligible amount of power, it was obvious that a considerable step forward could be accomplished in this class of work.

For such individual lights, a low voltage is very valuable, enabling as it does the use of half-watt type 12-volt automobile headlight lamps. A number of these lamps could be supplied from one low-voltage transformer, or alternatively this small winding could be placed in each motor, so that every individual motor supplied the lights for its own machine tool.

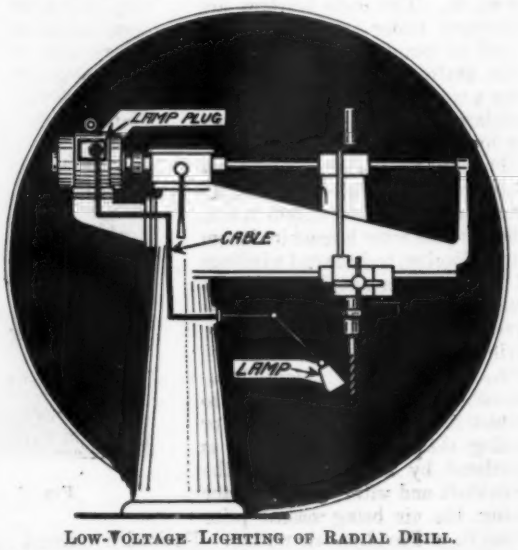
It was decided to adopt the latter method after consideration of the relative costs. The expense per point for the individual lights would not have been appreciably lessened by the adoption of the first method, whereas by utilising the new method it was greatly reduced, the actual cost of the small 12-volt coil being only a few shillings. The leads from this coil were carried through fuses to a small lighting plug-box situated adjoining the terminal-box for the power leads, but in future installations these two boxes would be made one, still further cheapening the device.

There then only remained a small plug, a few feet of flex, and the usual universal joint reflectors enabling the lamps to be held in any position convenient to the workman.

The total cost at the time was about half the price per point for lighting in the usual way, and if the suggestion for a common terminal-box just outlined were adopted, the figure would be appreciably less.

The efficiency of these half-watt lamps is, of course, comparatively high, and their use only becomes possible through the low voltage available.

The actual light required when thus brought right down to the work is so small, that the wattage consumed is almost



Low-Voltage Lighting of Radial Drill.

negligible, as compared with the standard 100-volt or 200-volt system ; moreover, these small 12-volt high-efficiency lamps are very substantial, and will stand far more vibration than high-voltage lamps, with consequent saving in replacements.

The saving obtained in power for a typical machine shop is, say, 40 per cent. or more, depending on the type of machine work and whether a large number of tools have

to be supplied. This further means an appreciable saving in power-station equipment, and consequent reduction in initial cost.

By the adoption of the above-mentioned arrangement, it will be noticed that two sources of light are available, one overhead from the separate lighting circuit and the other individual from the main power circuit. This has the further advantage that trouble on either of these circuits does not leave the shop in total darkness.

It was at first considered that this system might have two disadvantages: (1) That the light might flicker, or that undue stress would perhaps be put on the lamp at starting—but these defects were never realised; and (2) that the light would not be available when the machine was shut down. The latter was, however, overcome by having two plug holes on each motor, so that in case of shutting down of the machine the workman could plug his light into his neighbour's motor. In practice it will be found that the need for this plugging into the neighbouring motor seldom arises.

The second difficulty is also overcome by careful consideration of the following determining factors:—

(*a*) Proportion of working time spent in "setting up" for each tool and class of tools.

(*b*) Tools provided with gear boxes for speed variation, in which case a clutch is provided, and the motor is run all the time.

(*c*) Tools which keep motor running continuously owing to very little time being absorbed in moving work.

(*d*) Tools for which group drive is used, and two, or three, or four lights are supplied from one motor.

(*e*) Tools in which the interval for adjustment is relatively long, and plugging into a neighbouring motor is not too frequent, and causes no inconvenience.

In further connection with Mr. Scott Ram's report on fatal accidents, it is claimed that with this 12-volt system no accident could possibly occur. Such immunity was ensured by placing the coil at the bottom of the induction motor slot, and entirely separate from the power winding, a full power insulation test being made between the lighting coil and the power coil, as well as between the lighting coil and the frame.

The above arrangement is fundamentally an appreciation of the fact that the stator of an induction motor is a transformer. Such a scheme, therefore, must essentially be much cheaper than any arrangement of separate low-voltage transformers. In fact, whereas it is greatly cheaper than the system of obtaining a number of lights from one low-voltage transformer, it is, of course, infinitely cheaper than the arrangement—also considered at the time—of supplying a small separate transformer for each light. It also greatly simplifies the lay-out, wiring, and operating of such a machine shop; and the conception of each machine shop having its own general lighting, and each tool getting its own special strong individual light straight from its own motor, is thought to be a distinct step forward in simplification, reduction of first cost, and economy of operation.

To sum up, the writer would suggest the use of this lighting coil as a standard for any modern factory, and believes that so few cases where it is not applicable will be found that they can be altogether neglected. The low cost of equipping the motors with the coil and the resulting economy in initial outlay, operating cost, and saving in power, would seem to be such that the system merits extended use.

Dock Congestion at Constantinople.—The Department of Overseas Trade is informed that, to relieve the congestion which exists at the port of Constantinople, a compulsory sale will take place very shortly of all goods which have been lying in the Custom House for more than one year and one day. A list of such goods has been prepared, and it is stated that the British Chamber of Commerce of Turkey and the Balkan States (Inc.), 34/35, Buyuk Tunnel, Han, Galata, Constantinople, is in possession of full information. United Kingdom firms who are interested in this matter are invited to communicate with that body without delay.

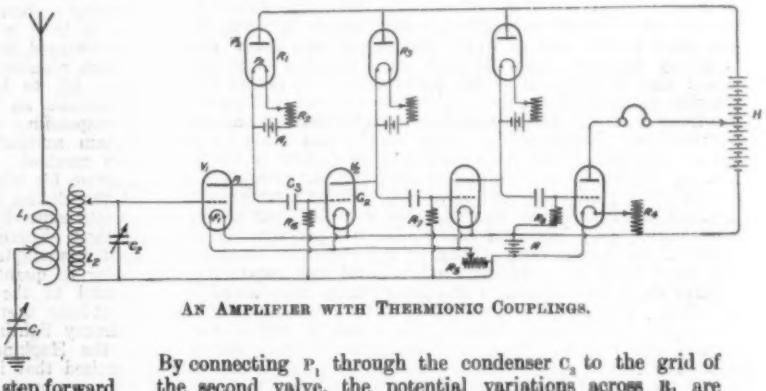
AN AMPLIFIER EMPLOYING THERMIONIC INTER-VALVE RESISTANCE COUPLINGS

By John Scott-Taggart.

The author has devised a large number of amplifying devices in which the coupling between the valves consists not in the usual form of resistances or transformers, but in thermionic couplings. In place of ordinary conductors of high impedance, it is proposed to use a conductive path between the cathode and anode of a vacuum tube such as the Fleming valve.

One form of the arrangement is shown in the accompanying figure, which shows the application of the arrangement to the reception of wireless signals.

An aerial circuit L_1 C_1 is coupled to a closed receiving circuit, L_2 C_2, which is connected across the grid and filament of the three-electrode vacuum tube V_1. The plate circuit of V_1 contains a two-electrode vacuum tube R_1 and the plate battery H. The valve R_1 may conveniently consist of an ordinary three-electrode valve in which the grid and anode are connected together. The filament, it will be noticed, is heated by means of an accumulator A_1, preferably through the five-ohm rheostat R_2. The electron current from the filament F_1 of the vacuum tube V_1 flows to the plate P_1, to the filament F_2 of the vacuum tube R_1, thence to the plate P_2, and so back to the filament F_1 *viâ* the battery H. The valve R_1 acts as a resistance of the order of 100,000 ohms, which value, however, may be conveniently varied by altering the emission from the filament F_2 by adjusting R_2. We thus conveniently obtain a non-inductive resistance whose value may be very readily varied, and whose normal value approximates to that of the valve V_1—a most desirable condition for effective amplification. By this means the voltage on the grid of V_1 will vary the resistance of V_1, and, consequently, vary the current in the circuit F_1, P_1, F_2, P_2, H, F_1. Since the current through R_1 is increased, the potential across P_2 and F_2 will also increase. If the grid of V_1 is positive, F_2 will become negative with respect to P_2.



An Amplifier with Thermionic Couplings.

By connecting P_1 through the condenser C_3 to the grid of the second valve, the potential variations across R_1 are impressed on the grid G_2, the condenser C_3 ensuring that grid G_2 is insulated from the high positive value which would otherwise be given to it by the battery H. The momentary negative potential on G_2 increases the resistance of the tube V_2, and so lessens the current in the circuit V_2, R_3, and H. Since the current through R_3 is decreased, the potential across R_3 decreases, and, consequently, the grid of the third three-electrode valve is given a positive pulse. The third three-electrode vacuum tube acts in a manner comparable to the first. The last vacuum tube is intended to act not as a high-frequency amplifier, but as a detector, and a pair of telephones is included in its plate circuit, a suitable tapping being taken from the battery H.

To assist us in arranging that the last valve shall act as a detector, we can conveniently make its filament current variable by the use of a separate rheostat, R_4. The current through the filament of the first three vacuum tubes may be varied by means of a rheostat, R_5. These three valves act as amplifiers of the high-frequency oscillations, and are not intended to act as detectors. Resistances R_6 and R_7,

having a value of about 4 megohms, are connected as shown and are intended primarily to prevent the accumulation of electrons on the grids of the second and third vacuum tubes. It is to be noted that the grids of the first three valves are connected to the negative side of the filament-heating accumulator; moreover, the rheostat R_5 is so connected that the grids will always have a potential negative with respect to the negative end of the filament. This will tend to prevent the establishment of grid currents in the first three valves.

If desired, the same effect could be produced by using a fixed resistance of about 1·5 ohms in place of the rheostat, R_5, the filament currents being then regulated by means of a rheostat connected between the positive side of the filament and the positive terminal of the accumulator. This latter arrangement is probably preferable.

A high resistance R_6 of about 4 megohms is connected between the grid of the last valve, and either the positive or negative side of the filament accumulator, according to which connection gives the best results.

In addition to the advantages gained by being able to vary each of the plate circuit resistances, the valve resistances R_1, R_2, &c., may be arranged to act as a limiting device, in which case the strength of signals may be easily controlled, and exceedingly loud signals or atmospherics may be cut down by suitably adjusting the rheostats R_2, &c.

The writer hopes in the near future to present a paper on further applications of thermionic inter-valve resistances, including devices of practical importance and value.

ELECTRICITY SUPPLY TARIFFS.

At the meeting of the North-Western Centre of the Institution of Electrical Engineers, which was held on February 24th at Manchester, Mr. J. A. Robertson presiding, an informal discussion on electricity supply tariffs was opened by Mr. S. J. Watson. He summarised under five headings the total cost of supplying electrical energy: Power station; transmission; transformation or conversion; distribution; metering and accounting. The annual cost per consumer of the expenses included in metering and accounting was constant whether the number of units used was large or small. In most of the other items the expenditure per annum was entirely unaffected by the number of units, but was fixed by the rate at which the supply was used. Substantially the only costs incurred in connection with each actual unit delivered after the undertaking was placed in a position to afford a supply, were those for fuel and part of the losses in transmission, transformation (or conversion), and distribution. Therefore, the power station cost could be resolved into two parts, the standing costs (taken at £x per kw. per annum of maximum demand), and the running cost (taken at y pence per unit sent out). For convenience he took £5 per kw. as the standing cost and 0.4d. per unit as the running cost, based on fuel at 32s. 6d. per ton. If the whole of the output were utilised by one consumer in exactly the same form as generated and without any expenditure outside the power station, a charge on those lines would be sufficient. But suppose there were three consumers, taking the supply in rotation, between 12 midnight and 8 a.m., 8 a.m. and 4 p.m., 4 p.m. and midnight. Clearly the expenditure at the power station would remain the same, and would be covered by a charge of £1 13s. 4d. per kw., plus 0.4d. per unit. Diversity of usage vitally affected the problem. A 100 per cent. load factor at the station would be equally attained whether a number of consumers had a load factor of 1 per cent. with a diversity of 100 or a load factor of 100 per cent. with a diversity of 1. Therefore, the standing cost could be fully secured by a charge per kw. of maximum demand per annum varying from £5 in the case of consumers having a load factor of 100 per cent. and a diversity of 1 to 1s. in the case of consumers having a load factor of 1 per cent. and a diversity of 100, the cost per unit supplied remaining unaltered.

He assumed £3 per annum per kw. of the rated capacity to cover the equipment of the transmission, transformation (or conversion), and distribution systems, and the constant losses and the attendance and maintenance incurred in connection therewith. This must be the charge if the supply had to be available night and day for one consumer only, whether it was used to the maximum extent for one hour per day or for the whole 24. If three consumers were using the equipment in rotation the charge would be £1 to each. Therefore, the standing portion of the costs incurred in transmission, &c., could be met by a charge per kw. of maximum demand per annum varying from £3 in the case of consumers having a load factor of 100 per cent. with a diversity of 1, to 7.2d. in the case of consumers having a load factor of 1 per cent. and a diversity of 100. Some addition should be made to the original running cost of 0.4d. per unit to compensate for losses in transmission, &c., which varied with the units consumed. Really transmission, transformation (or conversion), and distribution should be considered as three separate items. For suppliers to large industrial concerns two types of tariffs were in general use: (1) A compound charge per kw. demand, plus a charge for each unit used. (2) A flat rate roughly equal to the average per unit which the compound charge was expected to yield assuming a certain load factor. In both cases provision was made for a variation in the charge per unit to cover any change in the price paid per ton for fuel. If the assumption in regard to the load factor was correct, either method would yield the same return in revenue, but it was very difficult, if not impossible, to ensure that any particular load factor would be reached and maintained, and a flat rate per unit was often found insufficient owing to strikes, reduced hours of working, &c. For this reason the compound charge was becoming the standard practice, but there were considerable differences in the methods of applying it. Some undertakings combined a comparatively low standing charge with a high running charge, others made a high standing charge and a low running charge. Assuming a load factor of 33½ per cent., a compound charge of £6 per kw., plus 0.41d. per unit would yield the same income as £3 per kw., plus 0.66d. per unit, or as a flat rate of 0.90d. per unit. He was strongly of opinion that the running charge should be based as closely as possible on the cost of fuel, subject to the additional cost of losses incurred by each unit, and all other items of expense should be treated as standing costs, subject to a reduction based on diversity usage. The charges would then approximate as nearly as could be ascertained to the actual costs incurred. With regard to large bulk or industrial supplies, the general adoption of a 47 or 48-hours' working week instead of 54 to 56 had reduced the load factor from about 31.5 per cent. to 27 per cent., and as the diversity of this particular class of load rarely exceeded 1.2, the resultant usage of the whole equipment had been reduced from 37.8 per cent. to 32.4 per cent. The late Dr. John Hopkinson first worked out the details of a compound tariff, and recommended its adoption by the Electricity Committee of Manchester. The principles adopted by him in dividing up the costs were, with slight variations, accepted to-day. Dr. Hopkinson divided the costs into two parts: (1) Those which were independent of the hours during which the supply was used. (2) Those which were directly proportional to the actual units supplied. In its original form the Hopkinson tariff had not been generally applied to the smaller consumers. Other forms of tariff were the following: (1) A sliding scale of charges based on the number of units used per h.p. (2) Flat rates based solely on the number of units used. (3) The maximum demand system (introduced by Mr. Arthur Wright at Brighton in 1893) in which a high price (say, 3d. to 4d. per unit) was charged for the use of the maximum demand during a certain number of hours per annum, plus a much lower price (say, ½d. to 1d. per unit) for all additional consumption. Sometimes an intermediate rate was charged for the units, corresponding to the use of the maximum demand for a certain number of additional hours before the lowest rate was reached. (4) Flat rates per unit, depending on the purpose for which the supply was used. With the exception of the sliding scale based on quantity, all these tariffs gave results somewhat similar to those obtained by the Hopkinson method. There were few cases now where one flat rate per unit was adopted for power without any variation due to load factor or quantity. Such a rate would be extremely detrimental to the supply undertaking, as it would encourage short-hour users and discourage the long-hour users. For ordinary lighting purposes various tariffs, more or less akin to the Hopkinson, were in use. It was now generally recognised that in the case of a supply for domestic purposes the rates must vary from those applicable to ordinary lighting consumers. For lighting only the income derived from houses rated at £20 to £40 a year (which largely predominated in industrial areas) would not exceed an average of £3 to £6 per house per annum, an amount inadequate to cover the costs involved. Various special tariffs had been devised with a view to increasing the revenue by encouraging the use of the supply for purposes other than lighting. The requirements of such a tariff were that it should yield an income closely approximating to the costs incurred, it should be easily understood by the consumer, only one system of wiring should be needed with one meter, it should encourage consumers to use the supply for all purposes, and to wire for the maximum points of usage. A number of tariffs conformed broadly with those requirements by combining a fixed standing charge per annum with a low charge per unit. The standing charge could be arrived at in different ways: (1) By assuming a maximum demand based on the whole of the lamps and apparatus installed or on all average use of such appliances, and fixing the price per kw. for such assumed demand. (2) By assessing the standing charge as a percentage of the rateable value of the premises. (3) By fixing the standing charge at so much per room per annum, with or without allowances for each room in excess of a particular number. Each method had its disadvantages. The standing portion of the charge was obtained in a more or less arbitrary

fashion without regard to the value of the services actually rendered. Despite these defects, some of those systems had been found very effective in practice, and had resulted in a large increase in the consumption, and consequently in the revenue. Much less care was shown in using the supply if a consumer realised that only ½d. or 1d. per unit had to be paid after the standing charge was met, and additional consumption was thereby assured. The strict application of the Hopkinson differential charge or of the maximum demand system was unworkable for domestic purposes, but he advocated a form of tariff which would ensure a standing charge per annum, plus a low running charge per unit. If any considerable progress was to be made in the extended use of heating and cooking appliances the running charge must be fixed as low as possible. One very important factor was the diversity demand of this class of load. No really definite information on this point was available. As applied to small cottages and workmen's dwellings the system of a fixed annual charge per lamp installed, without any charge per unit used, had the advantage of simplicity, but it was apt to lead to a wasteful use of the supply, and could not be conveniently adopted when heating or cooking appliances were installed. The fact should not be overlooked that the total quantity of coal consumed for domestic purposes, in a district like Manchester, was much the same as the total quantity used by the whole of the manufacturing concerns. Much good would result if an effort was made to standardise methods, and remove the anomalies in the charges of adjoining undertakings.

Mr. J. S. Corlett (Wigan), in a written communication, said it was highly desirable that agreements should be standardised, and the responsibility of the consumer defined on reasonable and equitable lines. Uniformity on such points as period of time-lag, method of calculating coal increment, and resetting meters to zero, would be highly beneficial to the industry.

Mr. J. Frith explained that on the system of the mixed charge two consumers might have to pay equally, although the cost of supply was very different, because their maximum demands came on at different times. It was very difficult to see how the supply authorities could deal with that. He agreed as to the importance of having a tariff which was easily understood. It was also important that the consumer should be able to foretell what he would have to pay. Agreements were not quite so black as they were painted, but almost everyone could be improved from the consumer's point of view, and he found the authorities amenable to argument. A very important point in considering these questions was the nature of the supplying authority. When it was a municipality the ratepayers were combining to supply themselves, and the concern ought to be thoroughly co-operative, the object being to extend the benefits of the service to as many as possible of the owners (*i.e.*, the ratepayers), and not so much to make a profit out of every consumer. From this point of view it was to the good of the community that cottage property should be lighted by electricity, and the householders, being ratepayers, were entitled to share the benefits of the concern in which they were joint owners. But a company was governed (and quite rightly so) by other considerations. Its responsibilities were to the shareholders, and its object to make a profit for them, the only limit to the profit being what could be reasonably got out of the consumer to the ultimate good of the shareholder. A profit which restricted the use of electricity would not be to the ultimate good of the shareholder. It might even be good business to take on certain consumers at a temporary loss in order to popularise the supply. But it was another thing to compel a company to run its mains to a lot of cottage property where it was very difficult to show any chance of making a profit. A domestic tariff should encourage the use of electricity all over the house.

Mr. W. J. H. Wood said it was essential for the good of the community that tariffs should be simplified, and a common basis of charge established, possibly by a division into several classes. The fairest method was to make a fixed charge, plus a charge per unit. After the consumer had reached a certain limit he would be charged purely on the running cost. That was a great inducement. Take the case of a lighting consumer. The way to make greater use of the capital expended on his service, and at the same time improve the load factor, was to induce him to take power for domestic purposes. Usually two meters were adopted, but it seemed to him that they should strive for the one-meter service. He sympathised with what had been said about agreements. It should be borne in mind, however, that regulations must be made to safeguard the interests of the supplying authority, which should get a certain return on its money over a period of years.

Mr. S. L. Pearce said at the present time a uniform charge, even for various classes, was quite unattainable. The most they could hope for was to standardise the method by which the charges were arrived at. All correct tariff systems must be based upon correct costing, and that raised the question how was the expenditure to be analysed. The division into fixed costs and running costs was easy, the difficulty came in the application to the particular supply concerned. He was surprised that Mr. Watson put the power factor as low as 1.2; in Manchester it was substantially higher, the analysis for the last financial year showing 2.2. That had the effect of bringing down the kw. demand charge very substantially. The Hopkinson method of an alternative charge for lighting was still maintained in Manchester. Two-thirds of the total lighting sales being on that principle. It was easily understood, no second meter reading was required for a purely lighting system, and there was very little diversity about it. The combined tariff for domestic purposes could not be supported on scientific grounds, but it was appreciated by consumers, and filled a useful place. Any power supply agreement must make provision for variables, such as changes in the cost of coal. When District Boards had been set up the charges for bulk supply might become more or less standardised and uniform in a district.

Mr. L. Romero thought the Hopkinson system in a modified form could be applied to lighting with advantage, the consumers being divided into classes, and a maximum provided for each according to the diversity factor. Electricity had a promising field in the heating of rooms where artificial heat was only occasionally required, and in places where other forms of heating could not be applied, but he did not think that at present continuous electric heating was a proposition they could look forward to.

The Chairman said he thought they were aiming at an ideal which he was sure they would never attain, in trying to make every consumer pay for the energy he took precisely what it cost to supply him with it. The difficulty about the Hopkinson system was that it took no account of the time at which the maximum demand was made. That was a very important point, especially in large towns which had a large lighting load. However correct the maximum demand system might be in principle variations had to be made to meet particular cases. Subject to such variations, he thought it could be applied to large bulk supplies. In the case of household lighting and household suppy, what did it matter if one consumer got a slight advantage over another. It might be sound policy for a Corporation to sell under cost to artisans' dwellings, because of the indirect benefits in the way of better health, reduction of smoke nuisance, and so on. He had recently had a case before him in which a supply was required for about 500 houses, and he suggested to the local authority concerned that it should, for a year or two at any rate, charge a fixed sum, 1s. 3d. to 1s. 6d. per week in proportion to the floor space of the houses, and collect it with the rental. The time had come for a wholesale scrapping of the conditions which were made in the early days to regulate the supply of electricity. Some might have been necessary originally, but were not needed now. Others were unfair. The power factor condition should be made very definite, and not bear too hardly upon the consumer.

Mr. Franks suggested that a great deterrent to the more extensive use of electrical power was the uncertainty whether a breakdown might not be followed by undue delay in repairing and necessitate a return to the steam engine with belting and shafting. There was also uncertainty as to voltages, and whether motors installed would continue to be suitable. If a manufacturer knew that by taking the supply at certain hours he would get it at a cheaper rate he might modify his working hours in order to secure that advantage.

In his reply, Mr. Watson said changes caused by the war had entirely altered the bases on which prices were formerly fixed, and he thought in future they would be subject automatically to alteration as the changes in the conditions affected the cost of production. It would still be necessary to enter into agreements to ensure an adequate return on the money expended on mains and other things. It was desirable to reduce these matters to a common basis, and if engineers would meet and discuss them there would be no difficulty in doing so. Of all the systems applicable to domestic users, the most satisfactory was that in which the rateable value was adopted as the basis. The householder could judge to within a small margin what the cost to him would be, and the supply authority was assured of an income whether the house was occupied or not. It encouraged the use of electricity for every possible purpose. But the charge must come down to something in the neighbourhood of 0.4d. with coal at present prices, or 0.25d. at the pre-war level. He was acquainted with men who had entirely electrified their houses, and the cost worked out at £120 per annum. But that was on the basis of 1½d. If there was a reduction to ½d., the price would not be really excessive, and it would be worth while to do it. He had recently calculated what the 10s. reduction on coal for domestic use meant in his own town, and he found that the domestic units supplied in the two winter quarters was 5 per cent. of the total coal consumption, and in the other two quarters 3 per cent. Those figures indicated how little had been done in connection with domestic use. Mr. Pearce's figure of 2.2 was not taken on the same lines as his 1.2. He was surprised to hear that the Hopkinson method was applied to two-thirds of the electric lighting in Manchester, and still more surprised that Mr. Pearce expressed satisfaction with it. The experience of others was that consumers did not understand it, and distrusted it. If a 40-hours' week was introduced the men would probably start at 9 and go on till 5 or 5.30. Therefore, the industrial demand would continue during the busy period from 4 to 5 in the winter months.

DISK-DEPRESSION WELDING.

The disk-depression method of electric welding was developed primarily as a simple and effective means of forming a highly efficient joint or seam between heavy commercial plates. The following particulars relative to the method are taken from the *Southern Engineer*. After the preparation of the parts, by making depressions in the surface of one or both plates and introducing therein thin disks, the parts are brought into the proper juxtaposition and are then subjected to pressure and heating electric current between the terminals of an electric welding machine. The intermediate disks are welded to both plates, and are softened and forced into the depressions so as to permit the faces of the plates to come into immediate contact. The diameter of the disk is slightly less than that of the depression, but the thickness of the disk is greater than the depth of the depression, so as to hold the plates out of initial contact. The writer of the article in question usually employed flat disks in flat-bottom depressions, as he found that best results were obtained by making the area of initial contact substantially the same as the area of the desired weld, and applying the pressure normally to this surface. The surfaces of contact are thereby brought to a welding heat at all points at about the same instant, and a thorough fusion of the metals at all points is obtained by the time the intermediate metal is softened sufficiently to be forced into conformity with the depression. A plurality of such welds, properly staggered, makes an efficient joint.

Simple flat disks may be placed loose in flat-bottom depressions, as illustrated in fig. 1, which shows disks in depressions between two plates which are subjected to pressure and heating electric current between the terminals of an electric welding machine. Disks of varying thickness, flat on one side, and slightly conical on the other, give good results when placed in conical depressions. In order to hold the disks at the centres of the depressions during the progress of the work, small register projections on the disks fit snugly into register holes in the bottom of the depressions. Fig. 2 illustrates a drill for cutting the depressions and register holes. The cutting edge of the drill cuts the depressions while the small auxiliary drill cuts the register holes. The collar on the drill limits and determines the depth of the depressions. By means of multiple drills operating simultaneously, the depressions may be cut rapidly and economically. Movement of the disks may also be prevented by sticking them to the bottom of the depressions, which may be done by fusing them at one or more points of the contacting surfaces.

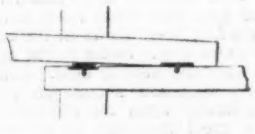


Fig. 1.

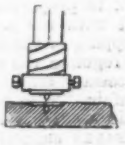


Fig. 2.

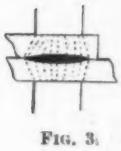


Fig. 3.

Fig. 4.

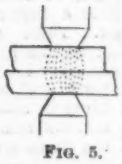


Fig. 5.

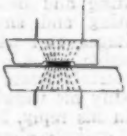


Fig. 6.

The depressions may be cut in the plates near their edges, and the plates are brought into juxtaposition with the depressions overlapping or falling beyond each other, so that, in a welded joint, the full strain can never come on a plate where it has been weakened in the least by such depressions.

Advantages of the disk-depression method of electric welding over riveting are claimed to be (1) a joint of greater strength and (2) greater economy in production. A joint of very high efficiency is obtained. The plates are not weakened by the cutting away of material in punching rivet-holes. The small amount of metal removed in making the depressions is negligible, and even this is restored by the disk-material which is fused into and completely fills the depressions. By cutting depressions in both plates near their edges, the full strain never comes on a plate where depressions have been cut. With proper means of bracing or mechanical framing, the seam can be completed for the present cost of rivets alone. The amount of heating current is relatively small, and the heating is limited to the immediate position of the weld. As the weld can be made rapidly, the conduction of heat by the plates causes very little heating of other parts.

The advantages of the disk-depression method over present methods of spot welding are claimed to be: (1) Greater thickness of plates, with (2) greater economy of welding current, (3) smaller capacity and less cost of welding machine, (4) portability of welding machine for very heavy work. As to the thickness of the material, there do not appear to be other drawbacks further than the matter of forcing through a very small distance into close contact.

The disks serve to confine the path of the welding current (fig. 3) and thus concentrate its heating effect. The advantage can be seen by contrasting with the plain spot-welding method (fig. 4), in which the welding current spreads out considerably and much heat is dissipated and causes distortion troubles. Similar trouble is experienced where it is attempted to use disks without depressions (fig. 5). As the disk is squeezed out (fig. 6) the heating current spreads considerably, practically no further welding occurs, and much difficulty is experienced in bringing the plates into close contact. But in the disk-depression method most of the heat is developed and concentrated at the disk surfaces (fig. 3), and at once it becomes so intense as to fuse the thin disk and to weld it to both plates before the surrounding portions of the plate become heated to any great extent.

The depressions are very shallow, and do not have to be spaced accurately. The disks may be manufactured by being cut in large quantities, as are small washers, and at less cost.

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.

On Monday last the annual general meeting of the Institution was held at the offices of the Electrical Contractors' Association. Mr. J. Y. Fletcher presided over a very small attendance—it may be an indication of satisfaction with the conduct of the Institution's affairs, but it is greatly to be regretted that so few members feel it to be their duty to be present at the annual meeting.

After the minutes of the previous meeting had been read and approved, the secretary, Mr. F. B. O. Hawes, read the report of the Committee of Management for the year 1919. It stated that the income benefited by the special appeal of Mr. C. E. Hunter, chairman in 1918, and that of Mr. H. J. Cash, who last year presided at the first festival since 1914. The income from contributions was £2,925, which, added to receipts from dividends, &c., brought the total income to £3,502, compared with £1,168 in the previous year. The net income for the year was £3,187, out of which four grants had been made, and the balance of £3,143 had been placed to capital account. The total amount of the invested fund was £12,539. Assistance had been given to every qualified person who applied for it. The value of local advisory committees had been further manifested during the year; the Glasgow and Cardiff committees had brought in new members and additional funds, and an advisory committee was being formed at Newcastle-on-Tyne, where a committee had organised a reception and dance in December last in aid of the Institution, with excellent results. Besides bringing in funds, the local advisory committees would investigate cases requiring assistance. The committee appealed to individuals and firms to become or appoint collectors; in the present report only three appear, but their efforts have been very successful. Mr. H. J. Cash's appeal at the dinner, supported by Mr. Hugo Hirst and Mr. C. H. Wordingham, resulted in the collection of £1,146. The committee draws attention to the advantages of membership; as there is now more than £10,000 invested, a member (or his widow or dependents) is assured of the ability of the Institution to afford adequate assistance, and by becoming a member one assists in helping others. The subscription of a member is 10s. (or more, *ad lib.*) and carries with it voting powers, when a pension is applied for. The report concluded with thanks to the electrical Press for assistance.

Commenting on the report, the chairman said that the number of members had increased from 115 to 181, and the number of life members was now 81, compared with 61, the subscriptions from this source having increased by £391. While the number of applications for assistance had been very small, the time was not far distant when the condition of the labour market would be very much changed, and there would be heavy calls on the resources of the Institution. The amount carried forward to capital account was £3,143, compared with £962 in the previous year.

On the motion of the chairman, seconded by Mr. H. Bevis, the report and accounts were unanimously adopted. Messrs. W. B. Esson, E. Garcke, T. E. Gatehouse, C. E. Hunter, Sir Ernest Spencer, and Mr. G. Sutton, members of committee retiring by rotation, were unanimously re-elected, together with Mr. J. Y. Fletcher and Mr. R. B. Mitchell (nominated by the Glasgow Committee). The hon. auditors, Messrs. Price, Waterhouse & Co., and the hon. solicitors, Messrs. Sugden & Hextall, were re-elected, with votes of thanks for their services. The chairman proposed that rule 17 should be amended by raising the limits respectively from £6 to £12 and from £50 to £100, to enable the committee to give adequate grants to the children of deceased members. This was agreed to, and the necessary confirmatory meeting will be held on Monday, June 7th, at 2.30 p.m., at the secretary's office, 36-38, Kingsway, W.C.

The proceedings closed with a vote of thanks to the Electrical Contractors' Association for the use of the room, and to the chairman for presiding.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A New Electric Seam Welding Machine.

The electric seam welding machine which is being placed on the market by Messrs. Marryat & Place, 28, Hatton Garden, London, E.C.1, embodies several new features which lead to what are claimed to be improved results. Hitherto seam welding has been carried out on a continuous process, the work being held between rollers which move it steadily forward and, at the same time, carry the welding current. The metal between the electrodes at any moment is almost instantaneously fused, and therefore it leaves the electrodes in a plastic condition which renders the seam liable to open under any stress to which it may be subjected during welding. Another disadvantage of the continuous process is that it involves the preliminary cleaning of the metal by sand-blasting or pickling. As the scale on iron has a lower melting point than the iron itself, it becomes fused in advance of the metal, and introduces a plastic layer between the electrodes and the metal. The coefficient of friction being thus reduced, the electrodes are liable to slip and to feed the work slowly and spasmodically. Those portions of the metal which remain too long between the electrodes are burned, and the clinging of the burned metal to the rollers aggravates the trouble and causes more burning. Hence with the older method there is necessity for constant cleaning of the electrodes, which adds to the expense and the time occupied in the process.

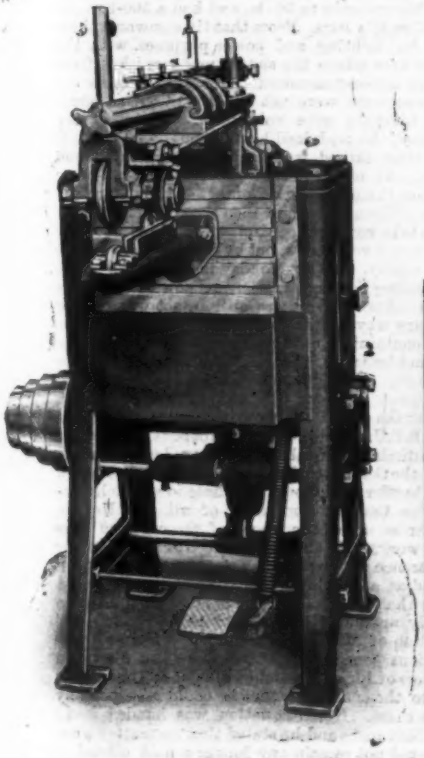


Fig. 1.—A New Seam-welding Machine.

These drawbacks are entirely eliminated, it is claimed, by the new machine, fig. 1, the essential feature of which is that the electrodes remain stationary during the brief welding period, and are revolved only to feed the work forward. As soon as the metal between the electrodes is fused the current is switched off, and a perfect weld is assured by a momentary additional pressure. Enough time is allowed to elapse to allow the weld to cool off and set, then the rollers revolve and feed the work forward for the next weld. By this arrangement the rollers invariably grip on relatively cold metal, giving a positive regular feed in spite of the scale on the surface.

The necessary series of operations is ensured by a simple and reliable cam action. In the first step the rollers are brought together in the usual way by means of a pedal operating through a spring. In the Marryat & Place machine, however, the pedal mechanism carries a toggle and a lever arm, and one end of the arm carries a roller which bears on a power-operated cam, while the other end is connected to the rod carrying the spring which controls the upper electrode, and which also actuates a trip switch to control the welding current. The cam and switch are so arranged that the current is switched on as soon as the electrodes are pressed on the work; then the cam raises the spring rod still further, simultaneously tripping the switch and giving the electrodes a further squeeze. After the interval for cooling the work is fed, either by hand or by power, until it is gripped again by the electrodes, and the same cycle of operations is repeated, giving a series of overlapping spot welds which form a watertight seam.

Application has been made for provisional protection for this machine.

A Selector Switch Box.

Messrs. Siemens Bros. & Co., Ltd., of Palace Place Mansions, Kensington Court, W.8, manufacture the 3-line selector switch box shown in fig. 3, for use on merchant ships.

This apparatus is employed when it is necessary to send instructions from one position to several outlying stations. The orders can be given to each station separately or to several stations simultaneously. The selector switch boxes are fitted with a 3-in. bell for calling and a flag indicator to denote which station is calling up.

A lamp, fitted inside the box, is lighted when a call signal is given by any of the outlying stations, the illumination being sufficiently bright to enable the flag indicator to be seen at night.

As the calling and speaking are carried out on distinct circuits, no interference or cross talk is possible if one station rings up while the home station and one of the outlying stations are already in communication.

For calling up from the home instrument, it is only necessary to turn the selector switch handle of the station required to the "on" position, and then to actuate the key or push of the instrument in the usual manner.

Calling from the outlying station is carried out in exactly the same manner as in the case of directly-connected instruments.

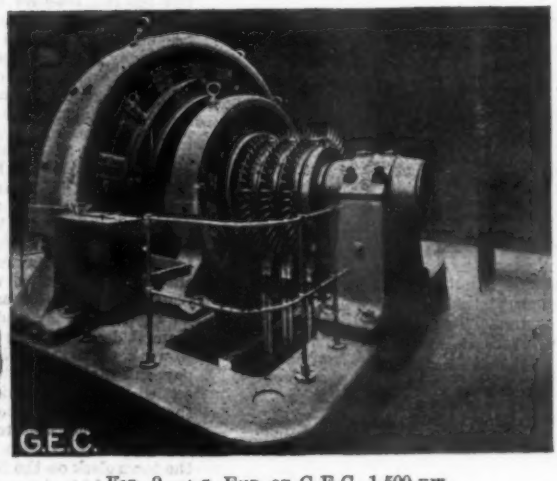


Fig. 2.—A.C. End of G.E.C. 1,500-kw. Rotary Converter.

Fig. 3.—Selector Switch Box.

A Large Rotary Converter.

A leaflet recently issued by the General Electric Co., Ltd., 67, Queen Victoria Street, E.C.4, gives particulars of a 1,500-kw. converter supplied to the Battersea Borough Council. It was required that the machine should convert either A.C. to D.C. or *vice versa* with a range of voltage of 6,000 to 6,600 on the H.T. side and 470 to 530 on the D.C. side, the power factor being maintained at unity at any voltage. In order to meet this wide range an alternating-current booster was fitted, having a potentiometer regulator in its field circuit. For inverted running the fields are excited from a direct coupled exciter so as to prevent the speed from rising unduly on account of lagging wattless currents.

When running A.C. to D.C. the converter is used as a shunt machine, but from D.C. to A.C. a compound field is put in circuit to steady the speed during fluctuations of the inductive

load. A change-over switch is mounted on the machine to cut the compound winding in and out. The converter is specified to start up from the D.C. side, but provision is made for fitting an A.C. starting motor at a later date. A three-pole switch is mounted on the machine to open the A.C. circuit during starting, and synchronising is effected on the H.T. side by means of an existing synchronising panel. Fig. 2 shows the A.C. end of the machine.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Trading Restrictions.

With reference to the letter appearing in your issue of April 16th regarding trading restrictions on metal-filament lamps, this is rather a surprise to many of the people in the trade, and I think it would be of interest if Mr. Edgecombe would reply to the following questions:—

1. Can any contractor stock, advertise, or sell lamps which are not controlled by his Association?

2. Can any graded retailer stock, advertise, or sell metal-filament lamps of any other than Association makes?

I notice he mentions that only factors (who it is agreed are agents for Association lamps) are bound down by this agreement, but I have before me a *retailer's agreement on group 1 lamps*, and one of the conditions reads as follows:—

"We agree not to advertise, stock, or solicit orders for metal-filament lamps of any type or group of other than Association makes (as set out in previous page)."

It would be interesting to have Mr. Edgecombe's reply.

Interested.

Newcastle,
April 20th, 1920.

Electrolytic Iron.

I have read with interest an abstract from the series of articles in *Le Génie Civil*, by Jean Escard, which appeared in your issue of April 16th, and I should be much obliged if you would allow me to point out one or two facts in connection with the article of which Mr. Escard does not appear to be aware, namely, that the process being worked by the Société "Le Fer" is the process developed by myself, and a licence was granted to that company under my patents, which is the process it is using now. Mr. Jean Escard also points out that I made iron tubes about the year 1908 by a process analogous to the copper cylinders manufactured by the Elmore process, but this is not the case. The process I employed was not analogous to the Elmore copper process, as no burnisher was used to make the deposited iron smooth, but the mandrels were revolved at a critical speed to give the necessary skin friction between the deposited iron and the electrolyte, as is now being done at the works of Messrs. Bouchayer & Viallet, who hold a licence from "Le Fer."

S. Cowper-Coles.

Sunbury-on-Thames.
April 24th, 1920.

Cost of Living in Algeria.

I notice that the Electrical Review frequently publishes information as to the cost of living in various parts of the world with a view to giving guidance to those who may be considering taking engagements abroad. I am sending you a list of approximate prices ruling at the present in Algeria:—

Rent (small flat suitable for two adults and two children), about 3,000 francs per annum; municipal tax on flat, 360 frs. per annum; coal (per ton), 600 frs.; general servant, 100 frs. per month; bread per kilo (2 lb. 2 oz.), 1 fr.; meat per kilo, 10 to 12 frs.; butter per kilo, 20 frs.; fish per kilo, from 4 to 8 frs.; tea per kilo, 25 frs.; coffee per kilo, 9 frs.; cheese per kilo, 15 frs.; sugar per kilo, 4 frs.; rice per kilo, 4 frs.; potatoes per kilo, 1 fr.; lard per kilo, 12 frs.; clothing (man's suit), about 450 frs., (woman's dress), about 350 frs.; boots (per pair), about 100 frs.

At the present time the rate of exchange is greatly in favour of anyone receiving payment in pounds sterling, but a study of these figures will show how high the prices of ordinary commodities are in Algeria at the present moment.

F. Dorrien Thoroton,
Sub-Commissioner, F.B.I.

Algiers.
April 22nd, 1920.

[We are very much indebted to our correspondent for these interesting and useful data.—Eds. Elec. Rev.]

THE SOUTHAMPTON STRIKE.

In a statement which refers to the salient points of the above strike, particulars of which were given in our last two issues, Mr. Harry S. Ellis, borough electrical engineer, informs us that both the Mayor and himself declined to interfere between the two Unions concerned, and at 10 o'clock one morning the men intimated that they would shut down the undertaking at 5 o'clock that night. They had intimated the same thing every night for a week during the trouble in connection with Messrs. Pirelli, when the Corporation refused to cut off the firm's supply, and so helped it to break the strike. About 5.30 p.m. on the 13th inst., the shift engineer, junior shift engineer and switchboard attendant walked out of the works and left the plant in the hands of Mr. Ellis, his chief assistant, and the power station superintendent. At 10 p.m. the B.S.U. called out the whole of the rest of the shift staff and left the three mentioned above in charge of the whole of the running plant, with the full load of the station on. Shortly after this, Mr. Dobson, the tramway manager, went down with two of his men, and Mr. Bennett, consumers' engineer, went down and took charge of the canteen and telephone. This staff kept the whole plant running with the full supply on, until the following morning at 10.30; at which time Mr. Ellis sent two of those who had helped him home for a few hours' rest, in order to make sure of the lighting load for the following evening and night. This left Mr. Ellis and Mr. Hooper and a lad of 16 in charge of the whole station. One or two volunteers began to turn up, and they decided to make an attempt to raise steam. By 4 o'clock they had stoked up the boilers and raised the pressure to 90 lb., and had a 500-kw. set running on the general supply bars. From that time onwards there has been a full supply for lighting and power purposes, with the exception of one small area where the supply was furnished from a sub-station containing motor-generators. In order to ensure the lighting supply, the tramways were not run for the time being. The staff referred to, together with volunteers, maintained the whole supply as described, the peak load being about 2,000 kw., for four days, by which time skilled men had been appointed and taken over their duties. As only three of the original staff were left, it was necessary for them to work from 15 to 18 hours per day on the average, as although the new men were skilled, it was impossible for them to take complete control. The three not only trained all the new men and volunteers, but by Sunday were able to run the full traction supply, and by Monday morning the whole supply was normal, including lighting, traction and power; and every consumer in the town whose service was still intact was getting his supply in the ordinary way. This included the training of men for sub-stations—one containing motor-generators and the other two motor-generators and batteries. On the Monday afternoon the Town Council met at 2.30. The Chief Conciliation Officer of the Ministry of Labour went down to try and bring the parties together, as a general strike of all the workmen in the town had been threatened. The E.T.U. claimed that Mr. Hooper should either re-join the E.T.U. or be discharged; otherwise it would call a general strike. As a result of the Committee having decided to take on new men permanently, and to offer to old men only those jobs which were still vacant, the Trades Council, consisting of all the Unions, threatened a general strike unless the whole of the old staff were allowed to return to work, and the new staff discharged. The Council and the Conference sat from 2.30 p.m. on Monday until 5 a.m. on Tuesday, and as a result of the conference the Town Council decided finally that the whole of the old men should return to work, that the newly appointed men should have two months' pay, and that the question of Mr. Hooper should be left over to be settled by the two Unions concerned. Mr. Ellis felt so disgusted that responsible members of his staff should walk out at a moment's notice, that he came to the conclusion that he could not possibly continue to work with them. His resignation was handed in to the town clerk on the 22nd inst., and he stated that no matter what they offered him he would not remain any longer a paid official of the Corporation. He has, on the other hand, offered that if he can do anything to assist with extensions in the capacity of an independent consulting engineer, he is prepared to take over the work upon terms to be arranged, but it must be distinctly understood that whatever work he does is done from his own office, and that he is an absolutely free agent to take up any other consulting work that he can secure. The question at the moment is, what is going to happen in the case of the chief assistant; Mr. Hooper, power station superintendent; Mr. Bennett, consumers' engineer; and Mr. Brookes, meter test-room superintendent, who are all members of the E.P.E.A. Mr. Ellis is not interfering with them at all; but he understands it is the intention of the secretary of the E.P.E.A. to call upon all these men to hand in their resignations, and to black-ball the Southampton electricity undertaking so far as E.P.E.A. men are concerned.

All the other Trade Union men, such as the A.S.E., general workers, blacksmiths, carpenters, &c., remained at their posts, but they would not assist in any way whatever in operating the plant. The strike affected every member of the shift staff, and the whole of the mains and consumers' departments, with the exception of the general labourers.

Mr. Mills, who was chief assistant in Mr. Street's time, went down and took charge of the mains department; and in spite of the fact that he had no men to assist him, he single-handed attended to all consumers' service faults, and in addition, when a H.T. main cut off one large district, he was able to get practically the whole of that district going again, the only part of that section left out being that on the Portswood side of the H.T. fault. By the time he was ready to tackle this fault, arrangements had been made for

the old staff to return to work again. Although Mr. Ellis asked the E.T.U. officials to send the whole of the men back to work immediately, the mains staff did not turn up until the following morning, with the result that part of the district referred to was without light for one night.

Mr. Ellis states that before the strike took place, he was on perfectly good terms with, so far as he knew, every member of his staff; and he believes that if it had been left with the staff to decide what to do, there would have been no strike at all. He also understands that the strike was not recognised officially by the principal officials of the E.T.U. in London.

During the six days of the strike it was practically impossible for Mr. Ellis or either of his assistants to leave the station for meals, and all meals taken were provided and served by Mrs. Ellis, with the assistance of two or three of her friends. According to the *Southern Daily Echo*, at the meeting of the Town Council on the 21st inst., a letter from the Mayor, Mr. S. G. Kimber, was considered, in which he tendered his resignation as chairman and member of the Electricity Committee. Mr. Kimber stated that the decision arrived at by the majority of the members of the Council not to honour the definite pledge of permanent employment given by himself on behalf of the Electricity (Emergency) Sub-Committee to those men who came forward to their assistance during the strike, and their further determination to reinstate the strikers, showed a want of appreciation of the successful efforts of his colleagues and himself to keep the station running. It showed a lack of confidence in his own administrative action, and made continuance in his office an impossibility. At the same meeting, Mr. Ellis's resignation of the post of borough electrical engineer from May 31st was also to be considered.

BUSINESS NOTES.

A Canadian Inquiry.—The Department of Overseas Trade has received a dispatch from H.M. Trade Commissioner at Toronto stating that a firm in that city wants quotations for quantities of 50 tons and upwards of electrical sheets for motor field magnets and armatures of 24 B.G. (0·023 in.). A small sample of the material in question was available for inspection on application to the Department of Overseas Trade, Room 50A, up to April 29th, when it was to be forwarded to firms in the provinces who may be unable to inspect it in London. The name and address of the inquirer can be ascertained at the Department.

Plant for Sale.—Clacton Urban District Council Electricity Department has for disposal two Davey-Paxman 150-B.H.P. double-cylinder Q type gas engines, direct-coupled to 100-KW. Thomas Parker D.C. generators; Whitby Urban District Council Electricity Department invites offers for one 100-KW. Parsons turbo-generator and one 28-H.P. vertical enclosed steam engine; Harrogate Corporation Electricity Department has for sale a 600-H.P. triple vertical steam engine, &c. For particulars, see our advertisement pages to-day.

A Swedish Transformer Competition.—It has long been considered in Sweden to be of national economic importance, from the point of view of standardisation, to obtain the most economical type, or series of types, of transformers which will meet the different requirements of consumption for average Swedish conditions. With the object of bringing about such a result, the Swedish Academy of Engineering Science (Ingenjors Vetenskap Akademien), of Stockholm, has opened a competition for proposals, which are to be submitted not later than October 31st, 1920, the sum of 2,500 kr. being offered in prizes. The problem put forward for solution is:—"Taking into consideration the costs of manufacture and working, what is the most appropriate construction for transformers, worked out on the basis of a systematic study of all the factors influencing the problem?"

A Dutch Company.—The report for 1919 of the Algemeine Nederlandsche Electriciteits Maatschappij (General Netherlands Electricity Co.), late Groeneveld, Ruempel & Co., of Amsterdam, states that the company's sphere of activity was extended during the year. The turnover, however, was less than in 1918, owing to the general fall in the prices of machines and of raw and other materials. It is intended to pay a dividend at the rate of 12 per cent. out of net profits of 208,000 fl., as compared with 26 per cent., and 535,000 fl., respectively, in 1918, the share capital having increased from 1,000,000 fl. in the latter year to 1,500,000 fl. in 1919.

National Federated Electrical Association.—At the annual meeting held on 20th inst., at the Chamber of Trade Rooms, Bradford, the following officers were elected for the ensuing 12 months:—Chairman of the Electrical Contractors' Association Incorporated, The National Electrical Contractors' Trading Association, Ltd., and the National Federated Electrical Association, Mr. A. Smith, of Messrs. Smith & Croft, Bradford; hon. secretary, Mr. H. Moss, 82, Leeds Road, Bradford; delegates to Chamber of Trade, Messrs. L. Jessop and H. Moss; delegates to the District Joint Industrial Council, Messrs. A. Smith, L. Jessop, F. Collinson, Casse and H. Moss.

Telephone Works at Coventry.—The industrial development of the Copsewood Estate, at Coventry, by the Peel-Conner Telephone Co., Ltd., is making considerable progress, and includes the erection of upwards of 80 dwelling houses on land adjoining the works. The works were designed by Mr. A. B. Strachan, architect, and the contractors are Sir Robert McAlpine & Sons, Ltd. The buildings are planned on lines which provide healthy conditions for the workers, and at the same time afford the maximum facilities for securing the best results as regards output. Provision is made for separate blocks of buildings set apart for the purpose of offices and administration, main factory, ebonite works, cabinet making, &c. The floor area of the factory buildings at present erected is about six acres in extent, but there is ample room for possible extension in the future. With the completion of the new works, this industry will be concentrated at Coventry, and existing works at Manchester will be closed down.

Belgium.—With the title of Fils et Cables Electrique, Société Anonyme, a company has been formed at Brussels, with a capital of 1,000,000 fr., for the manufacture and sale of electrical material, and, in particular, electric wire and cables.

A Bohemian Glow Lamp Factory.—It is reported from Prague that a glow lamp factory on a large scale is to be established in that city by a group to which the A.E.G. and the Osram Works belong, and in which English and American capital is said also to be interested. The factory is to serve the purpose of meeting the needs of Bohemia, the succession States, and the export trade.

Works in India.—In the report recently issued, Messrs. Fairbairn Lawson Combe Barbour, Ltd., state that a commencement has been made in the erection of works in India. For this purpose a separate company has been formed under Indian law, and a substantial issue of participating preferred shares of that company has been successfully made in Calcutta.

Liquidations and Dissolutions.—Quain Electrical Co., Ltd.—A petition for the winding up has been presented to the High Court by Messrs. R. & A. Main, Ltd., of Gothic Works, Angel Road, Edmonton, and will be heard on May 4th.

Chesterfield Tube Co., Ltd.—Winding up voluntarily for reconstruction purposes. Liquidator, Mr. J. G. Dixon, 6, Austin Friars, E.C.

Unelma, Ltd.—Winding up voluntarily; liquidator, Mr. F. T. Shearcroft, 36 and 37, Queen Street, E.C. 4. Meeting of creditors, May 4th, at Anderton's Hotel, Fleet Street, E.C. Claims to be sent to the liquidator by May 29th.

Alliance Electrical Co., Ltd.—Winding up voluntarily for reconstruction purposes. Liquidator, Miss E. McArthur. Meeting of creditors, May 3rd, at 32, King Street, Covent Garden, W.C.

Tooley, Emberton & Burrows, builders, contractors, and electrical engineers, 5, Lytton Grove, Seaforth, Lancs.—Messrs. T. A. Tooley, H. A. Burrows, and N. Emberton have dissolved partnership. Messrs. Tooley & Burrows will attend to debts.

French Electrical Companies.—The Société Electrique de la Sidérurgie Lorraine has been formed at Paris (63, Avenue Victor Emmanuel III), with a capital of 8,000,000 fr., for the erection and working of a motive power network knitting together the central stations of the ironworks and mines in the Lorraine district.

The Société Anonyme d'Appareillage Electrique Moderne (44 *bis*, Rue de Villejist), has been formed at Paris (previously erroneously described as the Société Anonyme Morse).

Under the style of the Electrique de Vendée, has been formed at Paris (Rue de Belzunce 11), a company for the production and utilisation of all forms of electric energy, especially in Vendée. Its capital is 1,000,000 fr.

The electric company styled Maison Bréguet has decided to raise its capital from 4,000,000 to 8,000,000 fr.

La Compagnie des Lignes Télégraphiques et Téléphoniques is the name of a new company which has just been formed in Paris (29, Rue de Londres), with a capital of 10,000,000 fr.

Wages in the Electricity Supply Industry.—The recent decision of the District Industrial Council for the West Midlands Area that, subject to the approval of the National Council, all electricity undertakings in the area should be recommended to apply Engineering and Foundry Trades Award No. 180 to all manual workers (except those workers whose wages are regulated by other Trade Union organisations), has now been approved by the National Joint Industrial Council for the Electricity Supply Industry. It will be remembered that the award gives an advance of 3s. per week from the beginning of April, and a further 3s. from the beginning of June.

All electricity supply undertakings in the West Midlands Area are, therefore, being notified to this effect, and are requested to apply the award to their employés forthwith.

The National Council adopts the view put forward by the District Council that in future any alterations in wages or working conditions are to be decided by the Industrial Council, without reference to any decision which may be come to by other industries. *Staffordshire Sentinel.*

Book Notices.—"Commutators as Structures" (36 pp.), "The Critical Speed of Shafts" (48 pp.), "The Submarine" (32 pp.), "Design and Applications of High-Speed Gearing" (42 pp.), "Lubrication of Bearings" (36 pp.), "The Design of Flat Plates" (62 pp.), and "Steam-Raising from Waste Material" (27 pp.). Gateshead-on-Tyne: G. W. Mason & Co.—The Association of Engineering and Shipbuilding Draughtsmen has been well advised to publish these excellent papers by its members; the lecture on commutators by Mr. R. J. Roberts, A.M.I.E.E., includes valuable data regarding stresses and methods of dealing with them. Every paper is illustrated by lucid detailed drawings.

"Vickers News." Vol. II, No. 14. Pp. 36. London: Vickers, Ltd.—The present number of this journal contains many interesting and informative features, including a description of the "B.B.H." oil switch, and an account of the changing over of the Sheffield Armour Department from the production of war *matériel* to peace products.

"British Standard List of Rubber Tires for British Standard Rims." Pp. 22. London: Crosby Lockwood & Son. Price 1s. net.—This memorandum was urgently called for by the need for reducing the great number of sizes in present use. Prepared by the British Engineering Standards Association, these specifications have been accepted by the British Rubber Tyre Manufacturers' Association. Copies may be obtained from the offices of the former Association, price 1s. 2d. post free.

"*Journal* of the Institution of Electrical Engineers." Vol. LVIII. March, 1920. No. 289.—This issue contains the following papers: "Transformers for Electric Furnaces," by Mr. J. L. Thompson; "Direction and Position Finding," by Captain H. J. Round; and an address to the Students' Section, by Mr. R. T. Smith.

The Supplement to Vol. LVII (published April, 1920), Part 1, contains the following papers: "Electrical Methods of Measuring Body Temperature, and Some Notes on the Cardiograph," by Mr. R. S. Whipple; "The Fullerphone and Its Application to Military and Civil Telegraphy," by Major A. C. Fuller; "The Oscillatory Valve Relay: A Thermionic Trigger Device," by Captain L. B. Turner; and "Magnetomotive Force Calculations for Cylindrical-Field Alternators under Steady Short-Circuit Conditions," by Mr. A. E. Clayton. London: E. & F. N. Spon. Price 10s. 6d. each.

"On the Detecting Efficiency of the Thermionic Detector." By H. J. van der Bijl, M.A., Ph.D. Reprint from the *Proceedings* of the Institute of Radio Engineers, New York.—In this paper the author describes a method of determining the detecting efficiency of vacuum tubes by feeding them with radio-frequency current, modulated at audio-frequency, and gives the theory of the method. The use of a receiver shunt calibrated in terms of miles of standard cable is advocated. Details of the apparatus used are given, with experimental data; a method of comparing the efficiencies of tubes is described, and a method of measuring tube amplification is explained.

"The Book of the Ford Van" (120 pp.). By R. T. Nicholson. London: Temple Press, Ltd. Price 3s. net.—This volume will be invaluable to owners and drivers of Ford vans—an ever-increasing section of the public. The work deals in a complete manner with every aspect of the question, including costs, capacity, loading, driving, and care and maintenance. Although the information given is applied to the "Ford," its usefulness will be apparent to owners of other makes as well.

"Silvanus Thompson, His Life and Letters." By J. S. Thompson and H. G. Thompson. Pp. vi + 372. London: T. Fisher Unwin. Price 21s. net.

"Electric Welding and Welding Appliances." By H. Carpmael. Pp. xii + 128; figs. 84. London: Constable & Co., Ltd. Price 18s. net.

Three-Shift System.—A Special Committee of the National Federation of General Workers has agreed to recommend to the Central Conference that the question of hours and arrangement for a three-shift system be left to the districts. At a meeting of the Committee an agreement between the Manchester District Engineering Trades Employers' Association and the A.S.E., S.E.M., and the Electrical Trades Union for the introduction of three shifts for maintenance men employed at the Pearson & Knowles Coal and Iron Co., Ltd., and the Partington Steel and Iron Co., Ltd., was quoted. Under this the shifts are:—First shift, 6 a.m. to 2 p.m.; second shift, 2 p.m. to 10 p.m.; third shift, 10 p.m. to 6 a.m. The hours on the first shift, which is termed the day shift, are 48, for 47 hours of which the full week's wages are paid, the remaining hour being at time-and-a-quarter. The second and third shifts, termed night shifts, consist of 40 hours of five eight-hour shifts, for which 48 hours are paid.—*Manchester Daily Despatch.*

The Dutch East Indies.—A Rotterdam newspaper of the date of April 20th, published a statement issued by the Netherlands Indian Gas Co. (Ned. Ind. Gas Mij.). The latter stated that at an extraordinary general meeting held the previous day, Mr. O. S. Knottnerus, manager, announced that a concession had been granted to the company for 40 years for the operation of gas works at Medan, and in this connection the opportunity had been taken again to seek to conclude an agreement with the Electriciteits Maatschappij "Medan." The result of the negotiations was that it had been determined that the gas company should take over the shares of the electricity company on the basis of an exchange of 6,000 fl. shares in the latter for shares of 2,750 fl. in the former company. In this way 75 per cent. of the shares in the electricity company would immediately pass into the possession of the gas company, whilst the opportunity for acquiring the remainder in this manner would remain open for five years. All the directors of the electricity company were retiring, and the management had been taken over by the gas company, and Mr. J. P. Jager, manager of the Medan central station, had been appointed a director of the gas company. The transaction had taken place at a price which was not too high, as the Medan station required to be entirely renewed, which would naturally be at the cost of the gas company, which intended, notwithstanding its own gas concession, to bring the working of the electricity works up to date. The capital already issued by the gas company was 4,190,000 fl., and as shares for 800,000 fl. were in portfolio, the purchase price could be defrayed by the exchange of 44,000 fl. in shares out of the latter. After referring to the extension of certain gas concessions, and the acquisition of a concession for a gas works at Bandoeng, the statement mentioned that an electric lighting concession had also been obtained at Macassar, where preparatory work had already been begun. In conclusion, it is stated that all these proposals and transactions were approved by the extraordinary general meeting. The address of the gas company is Willemsplein 10, Rotterdam.

Conference of Manufacturers.—The National Union of Manufacturers (Inc.) has called a conference of manufacturers, which is to be held at the Guildhall, E.C., on Friday, May 7th, at 2.30 p.m., when resolutions will be proposed:—

1. Entering a vigorous protest against the continuance of the Excess Profits Duty.

2. Making a request to the Prime Minister to set up a Committee to examine and report as to whether Government Departments which were created during the war as Departments of control, should now in whole, or in part, be closed down.

3. Appointing a deputation to wait on the Prime Minister with the resolutions of the conference.

The chair will be taken by Mr. George Terrell, M.P., the President of the Union.

Australian Report on the British Trade Situation.—In the course of its report for 1919, the Australian Association of British Manufacturers and their Representatives says:—"Experience has proved that the optimistic views expressed as to the prospects of post-war trade in the last annual report were not warranted. The position of British trade during the past 12 months has been little better than during the war years, mainly owing to industrial troubles in the United Kingdom, the general feeling or unrest caused by the sudden release from the intense nervous and physical strain of war, increased and increasing costs of living and the difficulty in estimating costs of manufacture. British manufacturers are at the present time under a very great temptation to neglect their overseas connection, especially in such a remote Dominion as Australia, owing to the large orders which are placed in the home markets, and high prices ruling. The majority, however, are sparing no effort to keep their overseas connections together, and all should bear in mind the fact that there is a certain value attaching to the goodwill which they have individually built up in the overseas markets, and if they neglect to protect that goodwill, the result will be to make it a present to their foreign competitors. Later, when orders from home markets have been fulfilled, manufacturers will be compelled to look further afield to find outlets for their goods, and they may find foreigners well established in markets which before the war were theirs. It would then be an expensive and laborious task to regain their old ascendency, as those who have obtained a lucrative trade for the asking, will not be inclined to give it away on the same terms. British manufacturers are, therefore, studying their own interests in resisting the temptation of disposing of the whole of their output at their factory door and reserving a certain percentage for keeping together or regaining their overseas connection, even if this course may mean some present sacrifice. During the war America and Japan have made great strides in their trade with Australia, and there is a real danger that, unless British manufacturers are placed on the Australian markets in normal quantities, and at competitive prices, Australian merchants may become so used to dealing in foreign goods that they will continue to buy the goods they know, rather than 'experiment' with others."

British-made Electric Bulbs.—A private conference was held, on Tuesday, between the Electric Lamp Manufacturers' Association and manufacturers of glass bulbs. The conference marks a further stage in the wresting the glass industry from Germany and its rehabilitation in this country. It was called to discuss a proposal for the further standardisation of British-made glass bulbs.—*Financier.*

Auction Sales.—By direction of the Disposals Board Ministry of Munitions, Mr. C. A. Charlton will sell by auction at the National Ordnance Factory (Cammell, Lairds), and the Radford Gas Works, Nottingham, on May 19th, a quantity of engineering plant and machinery, electric motors, centrifugal pumps, fans, &c. Messrs. G. M. Dixon & Co. will sell by auction at Northwich on May 13th and 14th the chemical plant, tools, &c., of H.M. Factory, Gadbrook, and the works of Messrs. Brunner, Mond & Co., Ltd., at Winnington. Full particulars are given in our advertisement pages to-day.

Swiss Enterprise in Rumania.—The *Economic Review* quotes a French paper to the effect that a syndicate, consisting of several electrical undertakings, metal works and engineers, has been formed by Swiss manufacturers for the purpose of undertaking, primarily, the repair of electrical plant and works in Rumania. The necessary material will be supplied by four Swiss factories. Workers and experts are to leave for Rumania very shortly. The syndicate is also disposed to undertake the repair of the railways and roads. Rumanian workers are to be employed, and to be given technical training.

Lead.—In their report, dated April 24th, Messrs. James Forster & Co. state :—

On Thursday, on publication of a cable from the Broken Hill district to the effect that the miners had refused to accept the terms offered them, there was a strong demand in all positions, July selling up to £43 12s. and closing at £41 10s. buyers.

The shipment of American lead round from Liverpool Stores has now practically ceased, and is not likely to be renewed. The lead was not at all liked, and much of the recent drop in values was undoubtedly due to it.

The scarcity of good brands is obvious, with premiums of 30s. to 40s. per ton being freely paid for Australian and even Spanish brands both by the trade and for export.

In the course of their report, Messrs. G. Cawson & Co. say :—

These purchases appear to have been based on the idea that the Broken Hill strike settlement has broken down. This does not appear to be a fact, as negotiations are still continuing and a settlement is expected next week.

The position generally has not changed, except that consumptive demand, if anything, is not quite so good. The stopping of all large building operations will tend to reduce consumption.

Supplies of lead are ample for all requirements, and are likely to continue so.

The outlook would point to a declining market, but so long as speculators continue to pay heavy premiums to finance their operations the market may perhaps still be maintained at the present high level.

A Reuter's dispatch from Melbourne, dated April 23rd, stated that negotiations for the settlement of the Broken Hill strike were proceeding satisfactorily. It was hoped that a settlement would be reached.

Socials.—A concert was given, last week, in aid of the Huddersfield Corporation Tramways Social and Athletic Club.

Pope's Electric Lamp Co., Ltd., Social Club held another successful whist drive and dance on Wednesday, April 14th. About 500 were present, and the evening was successful in every way. The music was supplied by the Imperial Syncopated Orchestra, and Mr. Trevor Carman, chief engineer, was amongst those present. Mr. E A. Marx, sales manager, presented the prizes.

Catalogues and Lists.—The Lea Recorder Co., Ltd., 28, Deansgate, Manchester.—Leaflets No. N 2, showing a cooling-tower installation at one of the Birmingham Corporation's power stations where the flow is registered by "Lea" recorders; W 2, a photograph of "Lea" integrating apparatus supplied to the N.S.W. Government, and several lists of users of "Lea" recorders in a variety of industries.

London Electric Storfs, Fulwood House, High Holborn, W.C. 2.—Illustrated and priced leaflet dealing with the "Holborn" fan regulator and the "Slidesie" fractional-H.P. motor regulator.

The Improved Solidite Co., Ltd., Advance Works, Jews Row, Wandsworth, S.W. 18.—Illustrated and priced list of "Solidite" insulating bushes, &c.

Enterprise Manufacturing Co., Ltd., Gun Street Electrical Works, Bishopgate, E. 1.—Price-list of direct-current starters for motors ranging from ½ to 25 H.P.

The General Electric Co., Ltd., 67, Queen Victoria Street, E.C. 4.—Installation Leaflets Nos. E 10 and A 17. The first, including eight illustrations, describes the electrical equipment of the Berthlwyd Colliery, Gowerton, South Wales; and the second illustrates a 1,500-KW. rotary convertor supplied to the Battersea Borough Council.

The Semaphore Engineering Co., Ltd., Advance Works, Jews Row, Wandsworth, S.W. 18.—Leaflet dealing with dry cells, and one describing a cycle electric lighting outfit, priced and illustrated; also order card for cells.

Messrs. T. E. Slaughter & Co., 172, Church Road, Mitcham, S.W.—Leaflet illustrating and describing the "Lyto" dry cell.

Messrs. Siemens Bros. & Co, Ltd, Palace Place Mansions, Kensington Court, W. 8.—Pamphlet B 705, illustrating and describing an electric helm indicator.

Automatic and Electric Furnaces, Ltd., 281/283, Gray's Inn Road, W.C. 1.—Heat Treatment Bulletin No. 20, "Abnormal Steels." Giving results of tests on samples of eutechtoid and high carbon steels.

The Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester.—Illustrated folder dealing with "Nine Points of Special Excellence about the Exide Battery" for motor-car starting, lighting, and ignition.

Surplus Aeronautical Material.—At the invitation of the Aircraft Disposal Co., Ltd., of which Mr. Godfrey Isaacs is chairman, and which has been incorporated for the disposal of all the surplus aircraft and accessories of the British Government, we had the privilege of seeing last week some small portion of the material which has been acquired under the contract. The sole managing and selling agents of the new concern are Messrs. Handley Page, Ltd., of Cricklewood, N.W. 2, and the purchase price, we understand, was £1,000,000, in addition to which 50 per cent. of any profits realised by the company from the sale or other use of the material taken over will accrue to the Government. After the inspection of part of the aircraft, material and equipment purchased under the contract, and now lying at Waddon aerodrome, in Surrey, a luncheon was given at the Savoy Hotel, at which a large number of guests from all parts of the world, besides representatives of the technical and daily Press, were present. The speakers were the Marquess of Londonderry, in the chair, General Sir Frederick Sykes, and Mr. Handley Page.

It is difficult to visualise the whole amount of material taken over when it is considered that the depôt which we saw at Waddon is but one of six which have been transferred, and that the contents of 130 more stations have to be sorted out and turned over to the new company. The material available for disposal includes 10,000 aeroplanes, 30,000 aero engines, £1,000,000 worth of instruments, and other accessories and materials in proportionate quantities, much of which is new and a large proportion in good condition. Mr. Page, in the course of his remarks, explained that the material and goods had been found to be readily adaptable to other than aeronautical purposes, and such things as the 1,000 tons of ball bearings, 350,000 sparking plugs, 100,000 magnetos, bolts, nuts and small accessories were finding a very ready sale with the present shortage of manufactured goods. Out of the large stock of instruments which they had, instrument sets for motor-cars were easily made up; revolution counters could be changed into speedometers; and aneroid barometers for registering height could be made into ordinary barometers for the more usual purpose of forecasting weather conditions. This did not, however, exhaust the list of possibilities; in engineering work large quantities of material were also being utilised. Engines designed for aircraft work ran satisfactorily on town gas; for instance, the Sunbeam "Arab" engine, which developed 200 H.P. as an aero engine, with its gearing removed, was being used at a lower speed as an efficient electric light and power plant, developing 50 H.P. Such a plant took but a small space, and could be purchased at a very low cost compared with the large low-speed gas engine which would otherwise be required. All these were, however, but side issues to the main problem of the disposal of aircraft, and it was to this that the company had directed its attention. To-day the prestige of British aircraft stood higher than any other in the world. It was early as yet for him to give the results of the sale of aircraft by the new company, but in the short period of its existence it had sold many more machines than the Aircraft Disposal Board had done during the whole period of its existence. It would be their endeavour still further to push the sale of British aircraft abroad, and for the good name already gained for British aircraft and, they hoped, for enterprise and energy, to remove the erroneous impression that sometimes existed that Britain lagged behind in selling efforts abroad.

Trade Announcements.—Messrs. Quead, Ltd., have removed their offices to 118-120, Victoria Street, S.W., to which address all communications should be sent. Telephone number: "3765, Victoria." The works are at Lewisham.

Messrs. Connollys (Blackley), Ltd., have opened offices and stores at Bradfield House, 27, Hunslet Road, Leeds, for the convenience of Yorkshire and Northern clients, and stocks of wire, &c., will be carried there.

Messrs. Drake & Gorham, Ltd., of London and Manchester, inform us that they are the sole concessionaires and manufacturers in the United Kingdom of the Ley-Allin electric time-checking system, described in the Electrical Review of September 7th, 1917, and since improved. The French rights are in the hands of Messrs. Burton, Fils, of Paris.

Messrs. W. E. Jones & Co., electrical engineers, have opened premises at 17, Queen Street, Deal (Kent).

The Sloan Electrical Co., Ltd., announce that their telephone number is altered to "2032 Clerkenwell" (4 lines).

Messrs. R. B. Hand & Co., Ltd., of High Holborn, W.C. 1, having secured an additional telephone, their amended number for all inward calls is "Museum 6286."

Automatic Telephone Developments.—It is announced by Mr. D. Sinclair, vice-chairman of the International Automatic Telephone Co., Ltd., of London, and managing director of its subsidiary company, the Automatic Telephone Manufacturing Co., Ltd., of Liverpool, that the new International Co. is vigorously prosecuting the introduction of automatic telephone equipment in foreign fields, and has received substantial overseas orders. Arrangements have been made by which the Western Electric Co., Ltd., of London, undertake under licence the distribution of Strowger automatic equipment as manufactured at Liverpool in certain territory outside of the United Kingdom and outside of the territory controlled by the International Telephone Sales and Engineering Corporation of New York and its subsidiary the Automatic Electric Co. of Chicago, U.S.A., and also outside of territory covered by the licences given by the Automatic Electric Co. of Chicago to Thomson-Houston of Paris. A substantial amount of new capital has been arranged for by the new International Co. for the extension of the plant of the Automatic Telephone Manufacturing Co., Ltd., of Liverpool, and it is expected that the manufacture of automatics on a large scale will be carried on there. The International Automatic Telephone Co, Ltd., is controlled by an International Syndicate composed of people who have been active in the management of the Automatic Telephone Manufacturing Co., Ltd., of Liverpool, and Theodore Gary and Company Syndicate of Kansas City, Missouri, U.S.A., who control the International Telephone Sales and Engineering Corporation of New York and the Automatic Electric Co. of Chicago. Among the International Syndicate members are Messrs. James Taylor and D. Sinclair, well known in connection with British manufacturing interests, and Messrs. Theodore Gary, A. F. Adams, and H. L Gary, who are, and have been for many years, prominently connected with large independent exchange and long-distance telephone properties in the United States. The Liverpool organisation remains unchanged, and the manufacture will proceed on the same lines as formerly, but the new arrangement will enable customers to benefit from quantity-production of automatic equipment. It will also make available for the benefit of Strowger business throughout the world the large staff of engineers controlled by the Automatic Electric Co. of Chicago, who were the inventors of the automatic telephone, and which company is the only organisation in the world to-day manufacturing automatic telephones exclusively and on the basis of quantity-production.

Electrical Factory in Jugo-Slavia.—An electrical repairing works, the only one in Jugo-Slavia, has been established at Agram under the name Première Usine pour l'Industrie Electrique Ivan Paspaet Fils. The section which makes electric torches can turn out from 6,000 to 8,000 a week.—*Economic Review.*

Strike at Lever Brothers.—A few days ago our Liverpool correspondent reported that the strike of electricians at Lever Brothers' Port Sunlight Works continued. The Electrical Trades Union men were holding a mass meeting this week.

Bankruptcy Proceedings.—E. Cloney, tramway divisional traffic superintendent, 5, St. Albans Road, N.W. 5.—Last day for proofs for dividend, May 11th. Mr. W. P. Bowyer, Official Receiver, Carey Street, W.C.

H. H. Shave (H. H. Roberts), electrician, Portsmouth.—First meeting May 7th; public examination June 7th, both at Portsmouth.

Catalogues Wanted.—Messrs. Alfred Mumford and Co., Ltd., of 14-20, St. Mary Axe, London, E.C. 3, who are electrical shippers to India and East Africa, desire to receive catalogues and other publicity matter.

Neuhausen Aluminium Co.—The directors recommend a dividend at the rate of 18 per cent. for 1919, as contrasted with 20 per cent. in the preceding year, leaving 799,000 fr. to be carried forward.

Oerlikon Accumulator Co.—The dividend of the Akkumulatoren Fabrik Oerlikon, of Zurich, is announced at 20 per cent. for 1919, as in previous years. In addition, a bonus of 10 fr. per share is being distributed in connection with the celebration of the twenty-fifth year of the company's existence.

Copper and Lead Prices.—Messrs F. Smith & Co. and Messrs. James & Shakespeare report, April 28th: No change in copper prices. Messrs. James & Shakespeare report, April 28th: English pig lead, £43 10s.—an increase of £3 on the week.

LIGHTING AND POWER NOTES.

Aberdeen.—Wages.—After conference with the E.T.U., a Sub-Committee has recommended, and the Council has adopted, the following scale of increased wages:—Electricity Department: Plumber-jointer, £3 17s. 6d. to £4 per week of 48 hours; jointer (ex-Service men of nine months' training), £3 5s.; turbo-driver, £3 17s. 4d. to £3 19s. 8d.; stoker, £3 15s. 5d.; meter inspectors, £3 to £3 5s.; armature winder (as labourer), £3 12s. 6d.; motor inspector, £3 5s. to £4 5s. Lighting Department: One foreman, £4 9s. 10d.; two lamp trimmers, £3 1s. 10d. Tramway Department: One armature winder, 1s. 10d. per hour; one wireman, 1s. 10d. per hour. The meter inspectors, in addition to their pay, receive uniforms.

Bognor.—Price Increase.—The company supplying electricity to the town has decided to increase its charges as follows:—Power, first 100 units in each quarter 6d. per unit, from 100 to 200 4d., and beyond 3d. per unit. Heating, first 50 units 8d. per unit, from 50 to 100 6d., and beyond, 4d. per unit.

Brazil.—Water Power.—According to a statement recently made by the Brazilian Institute of Engineers, after a great deal of investigation, there are 148 waterfalls in Brazil, capable of developing about 30,000,000 H.P.

Burnley.—Increased Loan.—Owing to the increased cost of materials since his estimate for extensions was made, the electrical engineer states that £75,000 will be inadequate, and advises application for a total of £150,000.

Accident.—Owing to the recent bursting of a steam-pipe at the Byng Street power station of the L. & Y.R. Co., a dynamo attendant was severely scalded.

Blean.—Overhead Transmission.—The Rural District Council has granted permission to the Whitstable Electric Co., Ltd., to erect overhead lines in the parish of Herne for the transmission of electricity.

Bromyard.—Electric Lighting.—The Urban District Council has decided to adopt electric lighting for the town.

Continental.—France.—A considerable increase in supply prices is to come into operation on May 1st, as a result of a decision of the Paris Municipal Council last week. An attempt was made at the meeting to secure an adjournment of the question of advancing prices until the problem of raising charges had been more thoroughly investigated, but this was unsuccessful, and a similar result attended a proposal to render uniform the charges for the supply of power at high and low tension, and to introduce rates for lighting graduated according to the consumption. The final result is that the monopoly company and any others which may come into consideration have been authorised as from May 1st, to charge 1·10 fr. per KW.-hour for lighting, 0·75 fr. per KW.-hour for all other purposes for low-tension supply, and 0·55 fr. per KW.-hour for high-pressure supply.

The Energie Electrique du Nord de la France has decided to increase its share capital to 75,000,000 fr. by the issue of 260,000 250-fr. shares, and to augment its bond capital to the extent of 100,000,000 fr. The company is one of those which have suffered from the invasion, but its daily energy production now reaches 10 per cent. of that before the war, while its plant capacity will shortly be equal to that existing at the declaration of war. Present circumstances, however, have now created such a demand for energy that the company finds itself forced to contemplate the establishment of a large new station. This will be situated at Commines, and planned for an output of 60,000 KW., being equipped with big sets of the most modern type. This addition will suffice for the service of the existing network and its more immediate developments. Eventually the station's capacity will be raised to 120,000 KW.

The Commission nominated by the Conseil Général of the Bouches-du-Rhône to examine the scheme for a departmental station has decided to apply to the State for a concession of a fall on the Durance River, and the engineer of the Ponts et Chaussées has been asked to draw up a list of the requirements:—(1) For departmental railway lines existing, and likely to be built; (2) public lighting service in the department; and (3) lighting of public monuments.

Denmark.—The country is at present supplied from 497 central stations having a total output of 108,000,000 KW.-hours per annum. The net sale to 205,000 consumers is 30,800,000 units for light, and 54,700,000 units for power.

The average net cost per unit in 73 towns is 4½d., in 387 villages 7½d., and in 37 agricultural districts 3½d. The high cost in the villages is chiefly due to the load-factor, which seldom reaches 0·10, and in a smaller degree to the high cost of fuel.

The supply of electrical energy from Norwegian waterfalls is being carefully considered. The distance from the nearest suitable falls to Copenhagen is about 75 miles, and it is proposed to send 26,000 KW. at a pressure of 50,000 volts by an overhead transmission line running through Sweden to Malmö, and thence by submarine cable across the Sound to Copenhagen.

The engineering difficulties in connection with this proposal are easily overcome, but the economic question presents some difficulty, as a low load factor would require a very expensive transmission line, and necessitate high prices to consumers. The estimated requirements of the country, provided cheap energy can be supplied, are about 450 million KW.-hours per annum. No final decision has, however, been arrived at.—*Technical Review.*

Spain.—The *Technical Review* states that a report upon the possibility and desirability of installing an industrial electrical network has recently been published. By separating the generation of power, transmission and distribution, and by eliminating too many independent lines, a great saving would be effected both by reducing the initial expense and the working costs. Such a network would also solve for the State the question of the provision of its own power, either for electrifying the railways or for other purposes, as the provisions made in the Bill would reserve to it these rights. Low-calorific-power coal, unsuited for transport, could be utilised to raise power. The main source of supply would be the waterfalls of the country, especially those of high head; and the country is especially favoured in this direction because high-water prevails at different seasons in different parts of Spain: in the Pyrenees in spring and summer, and in other parts of the country in winter. A careful investigation of the water power resources available has shown that a total of 2,000,000 KW. could be generated (excluding from the calculation falls yielding less than 2,000 KW.).

The proposed network would, as far as convenient, join up the main centres of production and consumption. It would be a peripheral polygonal network, with Madrid as the centre of consumption. The total length of lines to be constructed would be 4,810 km.

As regards cost, three types of feeders are considered, according to the quantity of power to be transmitted. These are 3 × 50, 3 × 75, and 3 × 100 sq. mm. cross-section. With the largest of these cross-sections it would be possible to transmit 25,000 KW. over a distance of 330 km., with a permissible voltage drop of 12 per cent. This particular line would serve Oviedo-Duero-Madrid, Tremp-Madrid, Tremp-Bilbao, and Tremp-Barcelona. The remaining sections of the polygonal network would be of 45 sq. mm. cross-section, with the exception of the section Seville-Granada and Valencia-Tortosa, which would be 50 sq. mm. In order to provide a reserve for emergencies, the Commission recommends the construction of two parallel lines, suspended from the same towers, with stations for line-protection every 100 km., and change-over stations every 25 km. Provision is also made for an earthing cable of 10 mm. diameter. Taking as a basis a price of 1 peseta per kg. for towers erected, and a price of 2 peseta per kg. for copper wire, the cost of the project is estimated to be 130 million pesetas.

The report recommends the preliminary construction of a network for 300,000 KW., which is about the power already available from other sources. The old systems would be joined up to the new one, thus giving initially an amount of 600,000 KW. available for consumption. As regards the unification of voltage, this will be an easy matter, since the frequency of 50 is practically universal in Spain and the current is three-phase. The voltage proposed at first is 150,000 volts.

Durham.—Lighting Scheme Abandoned.—The Board of Guardians has now definitely abandoned the scheme for electric lighting for the workhouse, which was to cost £500.

Dublin.—Loss of Revenue.—It is calculated that over £2,000 has been lost by the City Corporation's decision to cut off all lighting at night as a protest against the order forbidding inhabitants to be out in the city from midnight to 5 a.m.

Faversham.—Extensions.—The Town Council has decided to carry out extensions to the electricity works, at an estimated cost of £14,500.

Ireland.—Peat.—It is announced that Mr. Noel F. Harrison, who has had considerable engineering experience in hydro-electric work in the United States, expects to visit Ireland during the year to secure the co-operation of Town Councils and other bodies with a view to the development of the peat bogs of that country for the generation of electricity.

Java.—Hydro-electric Station.—The Government has granted a concession to a Norwegian, states the *London and China Express*, allowing him to erect a hydro-electric power station on the River Moesi, above Bankollen. The primary object of the plant is to provide power for the manufacture of synthetic nitrogen compounds. It is stated that the total available head is between 500 and 550 metres, and the total development will be 150,000 H.P.

Lanark.—Electricity Supply.—The Town Council has under consideration proposals for the provision of an electricity supply for the town.

Leicester.—New Station.—The Electricity Commissioners have sanctioned the erection of a new 50,000-KW. power station on Freemen's Common, and as soon as permission to borrow the necessary funds is obtained, the first installation of 20,000 KW. will be proceeded with.

Londonderry.—Public Lighting.—The Lighting Committee has decided for the continuance of public lighting after midnight, on account of danger to citizens during recent riotous outbreaks.

Nelson.—Bulk Supply.—The Town Council is to be asked to authorise an application to the Electricity Commissioners for an order under the Electric Lighting Act, 1909, permitting the supply of electricity in bulk to the Colne Corporation.

Newport (I. of W.).—Public Lighting.—The Town Council has agreed to pay the Electric Light Co. a fixed sum of £38 per quarter for public lighting, plus 4½d. per unit.

Oakengates.—Electric Lighting.—Consequent upon the refusal of the local gas company to lay mains required by the Urban District Council, the latter has appointed a Committee to consider the question of the installation of electric lighting.

Southend.—Increased Loan.—The loan sanctioned in 1914 for the sub-stations at Leigh and Thorpe Bay has been found inadequate, owing to the enhanced cost of plant, and the Council is, therefore, applying for an additional sum of £13,591.

Spenborough.—Bulk Supply.—The Council has ceased to generate its own electricity, and now takes a bulk supply from the Yorkshire Electric Power Co.

Swansea.—Railway Siding.—The Borough Council has asked the Great Western Railway Co. to lay a siding to the rear of the electricity works, the cost to be borne by the Council and the company to pay a yearly acknowledgment of £10.

Coal Supply.—The engineer has been instructed to confer with the Coal Controller and endeavour to obtain an adequate supply of fuel for the power station.

Scunthorpe.—Electricity Supply.—Having had under consideration the cost of a scheme for electrical distribution, the Scunthorpe and Frodingham Urban District Council has decided to make a canvass of the district to ascertain what the demand is likely to be in each part of the area.

Walsall.—Cottage Lighting.—The Corporation proposes the following terms for electric lighting in the new municipal cottages:—(*a*) An additional rent will be payable for electricity supplied for lighting at the rate of 3d. per week per lamp installed. Such additional rent will be payable weekly with the rent for the house. The electricity supplied at this rate may only be used for lighting purposes; (*b*) The tenant will be responsible for all missing, damaged, or defective lamps or shades, and damage to the wiring or installation, glazing, replacement of loose fixtures, and damage to any other part of the premises; (*c*) All burned out, damaged or broken lamps or shades must be replaced by, and at the expense of, the tenant, and to the satisfaction of the Corporation, but the tenant will be allowed the free replacement of one lamp per annum; (*d*) The tenant has the option of being supplied with electricity by meter at the tariff charges for the time being in force and under the conditions of supply issued by the electricity supply department.

Warrington. — Price Increase. — The Town Council has increased the prices of electricity, as from April 1st, by 10 per cent. for lighting and traction purposes, and by 20 per cent. for power and heating.

Worcester.—Loan.—The City Council is seeking permission to borrow £15,000 for the provision of sub-stations, transformers, switchgear, and cables.

TRAMWAY AND RAILWAY NOTES.

Australia.—Railway Electrification. — The Chief Electrical Engineer for Tramways states that the Railway Commissioners have a large scheme of electrical extension in contemplation, not only including the metropolitan railways, but eventually all the principal railways in N.S.W. The power-houses at Sydney and Newcastle are being enlarged, and other power-houses are to be constructed in more remote districts near coal and water supplies. The plan is to give a cheap electric supply to all the municipalities in New South Wales, to enable not only electric lighting, but also power, to be supplied to private consumers.—*Australian Mining Standard.*

Bradford.—Improved Service.—It is stated that the Corporation Tramways Committee has at last got back to its full complement of cars for use on its system. The 26 new cars, and the 78 new motors for refitting to old cars, have been received. The pre-war number of cars, 200, were used on Saturday, and it is thought this number will soon be exceeded.

Continental.—Belgium.—The *Economic Review*, quoting the *Écho de la Bourse*, states that the Chemin de Fer Electrique d'Ostende-Blankenberghe et Extensions Cie. reports that during 1919 the various lines belonging to this combination have resumed service.

The line Ostende-Furnes reached the latter place on August 23rd. The line Ostende-Knocke, which was already in working order to Blankenberghe, reached Knocke-le-Zoute on January 29th. For the coming summer season the line Coxyde-Village-la Panne, and the electrified Ostende-Westende line are expected to be in running order. The recovery of war damages is in active progress, a very important sum being involved. The Central Electric Railway, which began to run in November, 1918, will be entirely restored by the end of 1920. The present financial year will presumably offer a great many difficulties owing to labour troubles, and the increase in the prices of raw material and fuel.

Norway.—The Norwegian Council of State has decided to place before the Storthing a proposal to enter into a supplementary agreement with the Swedish Kirunavara-Luossavara A.B. concerning the transport of iron ore on the Norwegian Ofoten Railway, and the electrification of the latter. It is estimated that the conversion of the railway to electric traction will involve an expenditure of 5,500,000 kr., including the cost of four locomotives. If the scheme is sanctioned, authority is to be sought to conclude an agreement with the competent Swedish authorities for the delivery of electrical energy from the hydro-electric works at Porjus, until it is possible to obtain power from a Norwegian generating station. A vote of 3,000,000 kr. is asked for so as to be able to begin the work in the financial year 1920-1921.

Spain.—It is announced from Saragossa that another general strike has commenced which embraces the tramway workers.

Cork.—Coal Shortage.—The Cork Electric Tramway and Lighting Co. having been informed by the Neath Abbey Colliery Co. that, under order of the District Supplies Committee, it must cease supplying coal to Cork until English electrical requirements have been met, announced that it might be necessary to close down the tramway service temporarily, in order to conserve the small available stock for absolutely essential industries, and that, in the circumstances, the supply of electricity to Queenstown must cease. The coal shortage in all parts of Ireland is very acute, and it is feared many electrical undertakings will have to close down.

London.—Electric Railway Extension.—The Central London Railway will shortly open to traffic an important extension, which will prolong its line from the present terminus at Wood Lane, opposite the main entrance to the White City, to Ealing Broadway. This extension will not only round off the system, which originally only ran from Shepherd's Bush to the Bank, and will now reach from Ealing to Liverpool Street, but by linking up at Ealing Broadway with the Great Western line, it will provide a new and much-wanted through route between the City and West End and the western suburbs.—*The Times.*

L.C.C. Tramway Scheme.—On April 22nd the House of Commons refused to suspend Standing Order No. 22 in favour of the L.C.C. tramway scheme. This rule provides that the sanction of local authorities whose districts are affected by such a scheme must be obtained before Parliamentary Bills regarding the matter can be proceeded with. Practically all the Metropolitan Boroughs have protested against the scheme.

New Zealand.—Tramway Purchase.—The *Auckland Weekly News* states that the amount paid by the City Council to the Auckland Electric Tramways Co. for the whole of the latter's undertaking was £1,229,463, paid in 5 and 5½ per cent. debentures maturing in 1940. The gross profit of the undertaking for 1917-18 and 1918-19 was £81,162 and £60,856. The Council assumed control on July 1st last.

Post-Office Railway.—Time Extension.—The Minister of Transport has extended the time of the Post-Office (London) Railway Act until August 15th, 1921, for the completion of the railway and works.

Preston.—Renewals.—The Tramways Committee proposes to carry out renewals of the permanent way at an estimated cost of £10,000.

Swansea.—Tramway Strike.—The Corporation tramway employés ceased work on April 23rd, refusing to accept an increase of 8s. per week offered by an official award.

TELEGRAPH AND TELEPHONE NOTES.

Canada. — Aurora Borealis. — How the Aurora Borealis recently provided power for transmitting telegraph messages, is told by a Canadian newspaper. For 30 minutes, says the account, a Canadian Pacific telegraph line carried messages from Vancouver to Calgary on power supplied in this way. The Northern lights had been playing havoc with the circuits when the experiment was made. At both ends of the circuit the line had become earthed; the batteries were finally disconnected, and for half an hour the system worked perfectly, the power to transmit the messages being induced from the air.

Cable Operators' Grievance.—Trouble is brewing among the cable operators employed by the Western Union Cable Telegraph Co. in consequence of the dismissal of Messrs. A. D. Crisp and J. Doherty, two cable operators, who jointly edited the *Telegraph Cable Herald*, the official organ of the Telegraph Operators' Association. The dispute, according to the *Daily Express*, arose over a statement published in the *T.C.H.* relative to the death of Mr. R. Flexhel, an operator who, in the opinion of his colleagues, collapsed from overwork. Mr. Blenheim, traffic manager of the company at New York, telegraphed the dismissal of Messrs. Crisp and Doherty, stating: "It is a libellous statement, and such a charge is subversive of discipline." The Association considers the case to be one of victimisation, and in view of the fact that Mr. S. J. Goddard, the vice-president in London, has refused to hear either of the editors, it has threatened a general strike, in which the Electrical Trades Union may be involved. The Minister of Labour is conferring with the interested parties. According to the *Daily Herald*, reinstatement of the two men and recognition of the Association are demanded. The Association was formed in 1918, and has 600 members in London. Amalgamation with the E.T.U. is under discussion.

Dover.—New Channel Cable.—Two cable vessels left Dover on the 27th inst., says *The Times*, to lay a new submarine cable across the Channel to Ostend.

Ireland. — Wire Cutting. — At Midleton Quarter Sessions, last week, the Recorder of Cork awarded the Postmaster-General £27 compensation in respect of the malicious cutting of telephone and telegraph wires in the East Cork district.

London.—New Telephone Exchanges.—Sixty new telephone exchanges have been planned for London during the next 20 years, and an increase of over 250,000 subscribers is expected in that period. The exchanges to be enlarged number 17, and among the new exchanges on which work has been begun are those at Bishopsgate, Golders Green, the Tower, Stratford, and Hendon. Extensions are also being made at Barnet, East, Hampstead and Harrow.

High-Speed Wireless.—In a written reply to a question in the House of Commons regarding wireless telegraphic experiments at Woolwich, Mr. Churchill stated that wireless messages had been transmitted over considerable distances at the speed of 100 words per minute, and very much greater speeds had been obtained under laboratory conditions only. Funds at present available for experimental work were limited, owing to the urgent need for economy.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Algeria.—May 15th. Algerian Post and Telegraph Authorities at Algiers. Tenders for 25 tons of bronze wire, and 19 tons of copper wire.

Auckland (N.Z.).—September 1st. Harbour Board. For the supply of electric capstans and spares. Messrs. W. & A. McArthur, Ltd., 18-19, Silk Street, Cripplegate, London, E.C. 2.

Australia. — Perth. — May 3rd. Postmaster-General's Department. Insulators, bolts, brackets, &c. Schedule 673. (April 2nd.)

May 14th. Government of Western Australia. One 7,500-kw. turbo-alternator and condensing plant. (April 9th.)

Melbourne.—June 18th. City Council. Gas-filled metal-filament lamps. City Electrical Engineer's Office, Town Hall, Melbourne.

May 31st. Victorian Railways Department. Four 4,500-kw., 1,500-volt traction converter sets, and eight 1,000-kw., 1,500-volt ditto. (See this issue.)

Bacup.—Electricity Department. 30-ft. steel poles for street lighting purposes. (See this issue.)

Belgium.—Antwerp.—June 28th. Harbour Authorities (Town Hall). Two electric cranes of 30 tons and 10 tons respectively, for the new dry dock, and No. 61 of the Bassin Lefebvre. Copies of the specification in French, with tender form, price 4 fr., may be obtained on making application to: M. le Bourgmestre d'Anvers, Hotel de Ville, Anvers, Belgique, but a copy may also be consulted at the D.O.T. in London, on application to Mr. Shearer, Room 50, until May 8th, after which it will be available for loan to firms in the Provinces.

May 21st. Municipal authorities. Tenders for 10,690 metres of armoured cables, required in connection with the electrical equipment of the Nos. 2 and 3 docks. Particulars may be obtained for one franc from the Hotel de Ville, Antwerp.

Lincoln.—May 24th. Electricity Department. Coal-handling plant. (April 23rd.)

Leigh (Lancs.).—Electricity Department. One 2,500-kw. turbo-alternator; E.H.T. & L.T. switchgear; one 500-kw. rotary converter. (April 16th.)

Lochgelly (Fife).—May 5th. Town Council. Electric Lighting. Seventy-four new houses. Architect, Mr. A. D. Haxton, 3, High Street, Leven.

London.—Lewisham.—May 3rd. Board of Guardians. Installation of an electric fire-alarm at the Hospital, High Street. (See this issue).

Hammersmith. — May 21st. Electricity Department. Two 10,000-kw. turbines and alternators, with condensing plant. (See this issue.)

Metropolitan Asylums Board. May 11th. Installation of automatic internal telephones at the head office. (See this issue.)

Manchester.—June 7th. Electricity Department. Main and auxiliary switchgear; Section A, 33,000-volt and 6,000-volt main switchgear; Section B, pressure-testing switchgear; Section C, 420-volt A.C. auxiliary switchgear; Section D, 240-volt D.C. auxiliary switchgear. (See this issue).

New Zealand.—Wellington. June 30th. Tender Board Public Works. Electrical equipment for the Arthur's Pass section of the Midland Railway. Particulars from the Department of Overseas Trade, 73, Basinghall Street, E.C.

Nuneaton.—May 5th. Electricity Department. 3-core and 4-core, L.T., paper-insulated cables. (April 23rd.)

Rochdale.—One 1,250-kw. (alternatively 1,500-kw.) rotary converter. Mr. F. H. Rudd, borough electrical engineer, Electricity Works, Dane Street.

Salford.—May 10th. Concrete foundations for a 5,000-turbo-alternator. Borough electrical engineer, Electricity Works, Frederick Road.

Sheffield.—Corporation Water Works. Electric haulage winch, pug mill. (April 23rd.)

South Africa.—Mossel Bay.—Electric lighting equipment. (See this column, April 23rd.)

Spain. — May 30th. Construction and working of an electric tramway between the Plaza de la Bonanova and the Monasterio de Pedralba, Barcelona. The Direccion General de Obras Publicas, Madrid.

Madrid.—May 18th. Concession for an electric railway from La Corogne to Sarda, 18,000 metres in length; estimated cost, 2,000,000 pesetas, guarantee, 11,785·79 pesetas. The Concessionnaire is to supply the whole of the material and rolling stock. General Direccion des Obras Publicas, Madrid.

Tasmania.—Launceston.—June 7th. City Council. One 1,000-k.v.a. hydro turbo-alternator, with switchgear. City Electrical Engineer, Town Hall, Launceston.

Uruguay.—August 7th. Department of Posts, Telegraphs and Telephones. Construction of a national telephone system for the Department of Montevideo. Particulars from the Uruguayan Legation in London, 3, Elvaston Place, South Kensington, S.W.

CLOSED.

Australia.—Sydney.—City Council. Recommended:—

H.T. insulators (spec.) No. 581).—Lawrence & Hanson (first alternative tender, £3,387).

Sub-station equipment (spec. No. 558).—Section 1, with feeder switches of 48,000 k.v.a. capacity, £17,830. Section 2.—Met.-Vickers, Ltd., £13,120. Section 3.—Standard Waygood Hercules, £1,000.

Transformers, 5,000/33,000 v. (spec. No. 574).—Noyes Bros., £11,472.—*Tenders.*

Belgium.—The Belgian Post and Telegraph Authorities in Brussels have just divided contracts for the supply of a large quantity of telegraph and telephone apparatus between the Antwerp Telephone and Electrical Works, of Berchem, Antwerp; the Bell Telephone Manufacturing Co., Antwerp; and the Société Electricité et Mecanique, Carels Frères, of Ghent.

Three tenders were received by the municipal authorities of Belgrade (Province of Namur), for the installation and equipment of a transformer cabin and distribution system in connection with the electric lighting of the town, and also for the high-tension feeder. The lowest was that of Messrs. N. Van Gastel & Mertens, of Brussels, whose price for the two contracts was respectively 97,000 fr. and 36,358 fr.

Municipal authorities of Haccourt (Province of Liége) recently invited tenders for the concession for the supply of electrical energy for the electric lighting of the town, but no offers were received.

Eastbourne.—Corporation. Electricity works. Cooling tower and tank:—

	Treatment of timber.	£
Clyne Eng. Co., Ltd.	Pressure	2,514*
C. Bradshaw & Co., Ltd. ..	Dipped	3,500
Premier Cooler & Eng. Co., Ltd.	**Vac. & Pres.** (recom.)	**3,805**
Premier Cooler & Eng. Co., Ltd.	Dipped	3,570
Film Cooling Towers, Ltd. ..	Dipped	4,010
Davenport Eng. Co., Ltd. ..	Vac. & Pres.	4,312
Davenport Eng. Co., Ltd. ..	Dipped	4,198
Hudson Econ. Co., Ltd. ..	Dipped	4,566
W. H. Roy & Co., Ltd... ..	Dipped	4,350*

*For tower only.

Glasgow.—Tramways Committee. Accepted:—

Rail welding plant.—Hitchcock, Lloyd & Co.

120 Toc Cam brakes.—Dryers, Ltd.

Pneumatic hoist.—Consolidated Pneumatic Tool Co., Ltd.

Electric battery truck.—Hendry Bros., Ltd.

Two 2-ton motor lorries.—Bryson Bros.

Government Contracts.—The following Government contracts have been placed during March, 1920.

ADMIRALTY (CONTRACT AND PURCHASE DEPARTMENT).

Electric lighting, heating and power wiring.—G. E. Taylor Co., Ltd.
Internal electric wiring.—T. Fairie & Co., Ltd.
Electrodes.—Quasi-Arc Co., Ltd.
Feed pump.—Rees Roturbo Manufacturing Co., Ltd.
Platinum wire and sheets.—Johnson, Matthey & Co., Ltd.
Steam superheaters for boilers.—Babcock & Wilcox, Ltd.
Torch batteries.—British Ever-Ready Co., Ltd.
Water-tube boilers.—Babcock & Wilcox, Ltd.

MINISTRY OF MUNITIONS.

Copper wire.—T. Bolton & Sons; India-Rubber G.P. & Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.
Electric batteries.—Accumulators of Woking, Ltd.; Tudor Accumulator Co., Ltd.
Electrical equipment.—Edison Swan Electric Co., Ltd.
Electric motors.—Bruce Peebles, Ltd.; General Electric Co., Ltd.; J. H. Holmes & Co., Ltd.; Metropolitan-Vickers Electrical Co., Ltd.
Insulators.—Bullers, Ltd.
Insulated wire.—G.E. Co., Ltd.
Electric lamps.—British Thomson-Houston Co., Ltd.
Pump installation.—Variable Pumps & Motors, Ltd.
Rotary transformers.—Newton Bros. (Derby), Ltd.

INDIA OFFICE: STORES DEPARTMENT.

Cells.—Chloride Electrical Storage Co., Ltd.
Gutta-percha core.—Siemens Bros. & Co., Ltd.
Crucibles.—Morgan Crucible Co.
Cutting compound.—Dussek Bros. & Co.
Dynamo.—J. Stone & Co., Ltd.
Fans.—J. Stone & Co., Ltd.
Generator.—Lancashire Dynamo & Motor Co., Ltd.
Switchboards.—Erskine Heap & Co.; Metropolitan-Vickers Electrical Co., Ltd.
Train lighting equipment.—J. Stone & Co., Ltd.

POST OFFICE.

Telegraph apparatus.—Automatic Telephone Manufacturing Co., Ltd.; British L.M. Ericsson Manufacturing Co., Ltd.; International Electric Co., Ltd.; Phœnix Telephone & Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; T. E. Thompson & Co., Ltd.; Whitfield Aviation, Ltd.
Telephone apparatus.—Automatic Telephone Manufacturing Co., Ltd.; British L.M. Ericsson Manufacturing Co., Ltd.; Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.; International Electric Co., Ltd.; C. Peacock & Co., Ltd.; Peel Conner Telephone Works, Ltd.; Phœnix Telephone & Electric Works, Ltd.; Siemens Bros & Co., Ltd.; Sterling Telephone & Electric Co., Ltd.; Western Electric Co., Ltd.
Telephone and telegraph cable.—British Insulated & Helsby Cables, Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Hooper's Telegraph & I.R. Works, Ltd.; New Gutta-Percha Co., Ltd.; Siemens Bros. & Co., Ltd.
Earth clips.—E. Showell & Sons.
Insulators.—J. Bourne & Son, Ltd.; Bullers, Ltd.; Doulton & Co., Ltd.; Litholite Insulators, Ltd.; Taylor, Tunnicliffe & Co., Ltd.
Terminal irons.—D. Willetts, Ltd.
Earth plates.—T. & W. Farmiloe, Ltd.
Distribution cable plugs.—Siemens Bros. & Co., Ltd.
Stay rods.—Bullers, Ltd.
Zinc rods.—Siemens Bros. & Co., Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; British Insulated & Helsby Cables, Ltd.
Enamelled and S.S.C. copper wire.—London Electric Wire Co. & Smiths, Ltd.
Flexible twin, &c., E.I. wire.—Macintosh Cable Co., Ltd.
G.I. strand wire.—Rylands Bros. & Co., Ltd.; Whitecross Co., Ltd.
V.I.R. wire.—Hooper's Telegraph & I.R. Works, Ltd.
Circulating pump: P.O. central power station.—Rees Roturbo Manufacturing Co., Ltd.
Laying conduits.—Spalding: Hodge Bros. (Contractors), Ltd. Hop-Victoria: J. Mowlem & Co., Ltd. Park-Ealing: J. Mowlem & Co., Ltd. Hop-Lee Green Junction: R. M. Parkinson. Greenwich-East Junction: W. H. Wheeler & Co., Ltd. Willesden (Walm Lane): O. C. Summers. London-Southampton (section I): Hardy & Co. London-Southampton (section II): R. Armistead. London-Bristol-Newport (South Midland, section 1): J. F. Hodge & Co. Southall: G. I. Anderson. Glasgow: R. & C. Murray.
Telephone Exchange equipment.—Malvern: Automatic Telephone Manufacturing Co., Ltd. Cardiff: Automatic Telephone Manufacturing Co., Ltd. Ilkley: Siemens Bros. & Co., Ltd. Birmingham (south): Peel Conner Telephone Works, Ltd. Willesden: Peel Conner Telephone Works, Ltd. Guildford: British L.M. Ericsson Manufacturing Co., Ltd.

H.M. OFFICE OF WORKS.

Engineering services, generating sets for Ministry of Pensions.—Saltash: Aster Engineering Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Telephone cables, &c.—Callender's Cable & Construction Co., Ltd. British Insulated & Helsby Cables, Ltd.
Spares for Diesel engines.—British Electric Co., Ltd.
Telephone switchboards.—British L.M. Ericsson Manufacturing Co., Ltd.
Telephone materials.—British L.M. Ericsson Manufacturing Co., Ltd.
Train lighting spares.—J. Stone & Co., Ltd.
Bronze wire, &c.—F. Smith & Co., Ltd.

PUBLIC WORKS, DUBLIN.

Dublin Electric Works and supplies.—Handley & Robinson, Ltd.

London.—HAMMERSMITH.—Electricity Committee. Annual contracts for stores and materials. In view of the few tenders and the conditions attached, the Committee considers it would not be advantageous to accept any for the time being, and recommends that it be authorised to obtain and accept quotations from various firms for the supplies of material required from time to time within the estimates during the current year.

MAINS EXTENSIONS.—8,000 yd. '15 E.H.T. six-core cable:—

Western Electric Co., Ltd.	£9,998*
Enfield Ediswan Cable Works, Ltd.	10,066
W. T. Henley's Telegraph Works Co., Ltd.	10,100
B.I. & H. Cables, Ltd.	10,100
Siemens Bros. & Co., Ltd.	10,207
Union Cable Co., Ltd.	10,333
Callender's Cable and Construction Co., Ltd.	10,400
W. T. Glover & Co., Ltd.	10,400
Pirelli General Cable Works, Ltd.	10,442
Johnson & Phillips	10,500

* Recommended for the supply of 5,000 yd.

2,000 yd. '15 L.T. three-core cable, £1,721; and 1,000 yd. '05 L.T. concentric cable, £958—Western Electric Co., Ltd.

2,000 yd. '1 E.H.T. concentric cable, £858; 1,000 yd. '25 E.H.T. concentric cable, £804; 2,000 yd. '1 L.T. three-core cable, £1,308; and 3,000 yd. 7/22 L.T. twin cable, £375—Enfield Ediswan Cable Works, Ltd.

CABLE DUCTS.

	4,000 yd. 4-way 4 in.	1,000 yd. 3-way 3½ in.	2,000 yd. 2-way 3½ in.	2000 yd. 1-way 3½ in.
Doulton	£9,009 (3½ in.)	£394	£560	£261 (3 in.) £380 (4 in.)
Sutton & Co.	£2,454	£371	£538	£360
Albion Clay Co., Ltd.	£2,584	£394	£560	£382 (3 in.)
Sankey & Co., Ltd.	£2,454	£371	£533	£429 (4 in.)
Key Engineering Co., Ltd.	Quote for fibre conduit, (not according to specification)			£321

The Committee recommends the acceptance of the tenders of Messrs. Doulton & Co. for 2,000 yd. 1-way 3 in. cube ducts at £281, and of Messrs. Sankey & Co. for 4,000 yd. 4-way 4 in. cable ducts at £2,454, 1,000 yd. 3-way 3½ in. cable ducts at £371, and 2,000 yd. 2-way 3½ in. cable ducts at £533.

The Committee reports that the electrical engineer has carefully considered the various tenders for switchgear, and upon his report has decided, having regard to the high prices quoted, and the unduly long periods stated for delivery, to amend the specification and to invite fresh offers thereon.

TRANSFORMERS.

Four 1,000-kw. single-phase transformers, £4,202; two 500-kw. single-phase transformers, £1,319; and three 500-kw. three-phase transformers (mesh star connected), £2,494. British Electric Transformer Co., Ltd.

BATTERSEA.—Electricity Committee. Recommended:—

Switchgear for the turbo-alternator and rotary converter.—Edison and Swan Co., Ltd.
Six lamp columns, £345.—Mackenzie & Moncur, Ltd.
Testing panel, £208.—Bertram Thomas.

Renewal of contracts for one year recommended:—

Electricity meters.—Chamberlain & Hookham, Ltd., Ferranti, Ltd.
Electrolytic meters.—Reason Manufacturing Co., Ltd.
Box compound and "Trindite" bitumen composition.—Dussek Compound Co., Ltd.
Coal.—Rose, Smith & Co.

STEPNEY.—Electricity Committee. Accepted. 5,000 pairs of yellow-flame arc carbons:—

Sloan Electrical Co., Ltd. (accepted)	**£112**
G.E. Co., Ltd.	127
W. White & Co., Ltd.	148

Six feeder boxes:—

W. Lucy & Co., Ltd (accepted)	**£198**
Universal Electrical Manufacturing Co.	207
Henley's Telegraph Works Co.	252
British Insulated & Henley's Cables, Ltd.	266

Turkey.—The *Journal of the British Chamber of Commerce* just to hand, states that an important contract for the electrical installation of the Haidar Pasha terminus station and its various dependencies, buildings, and factories, was put up to public adjudication, and the various electrical contractors of this city of all nationalities participated keenly. "We are pleased to learn that three British firms competed, and that one of them was successful in obtaining the contract."

FORTHCOMING EVENTS.

North East Coast Institution of Engineers and Shipbuilders.—Friday, April 30th. At the Literary and Philosophical Society, Newcastle-on-Tyne. At 6.15 p.m. Paper on "A Modern Power Station and its Development," by Mr. J. S. Watson.

Junior Institution of Engineers.—Friday, April 30th. At 39, Victoria Street, S.W. At 7.30 p.m. Social evening.

Friday, May 7th. At 7.30 p.m. Lecturette on "Pulverised Fuel," by Mr. J. O. McBryde.

London Association of Foremen Engineers.—Saturday, May 1st. At Cannon Street Hotel. At 6 p.m. 67th anniversary festival.

Institution of Electrical Engineers (Western Centre).—Monday, May 3rd. At the Public Library, Alexandra Road, Swansea. At 6.30 p.m. Kelvin lecture on "Modern Marine Problems," by Dr. C. V. Drysdale.

(Students' Meeting).—Friday, April 30th. At Faraday House, Southampton Row, W.C. At 7 p.m. Paper on "Tidal Power," by Mr. J. E. Holmstrom.

Society of Engineers.—Monday, May 3rd. At Burlington House, W. At 5.30 p.m. Paper on "The Assessment of Engineering Undertakings," by Mr. W. G. Cooke.

Roentgen Society.—Tuesday, May 4th. At 11, Chandos Street, W. At 8.15 p.m. Paper on "Some Problems in the Action of Radiation upon Tissues," by the President. Demonstrations: "The Transmission of Speech by Light," by Prof. A. V. Rankine, and "A New Portable Viewing Lantern," by Dr. H. A. Eccles.

Faraday House Old Students' Association.—Tuesday, May 4th. At the Holborn Restaurant. At 6.30 p.m. Annual dinner.

Chief Technical Assistants' Association.—Thursday, May 6th. At Anderton's Hotel, Fleet Street, E.C. At 7 p.m. Resumed discussion on "The Design and Equipment of Sub-stations."

Chemical Society.—Thursday, May 6th. At Burlington House, Piccadilly, W. At 8 p.m. Ordinary Scientific Meeting.

Iron and Steel Institute.—Thursday and Friday, May 6th and 7th. At the Institution of Civil Engineers, Gt. George Street, S.W. At 10 a.m. Annual meeting.

Association of Engineers-in-Charge.—Saturday, May 8th. At the Holborn Restaurant (Venetian Chamber). At 6 p.m. Annual dinner.

The Kinema in School.—Ealing elementary school children began to have lessons by film, this week, the Education Committee having rented a local kinema theatre for the purpose of showing educational pictures. It is hoped to develop the idea so that a fortnightly visit will fall to the lot of each child.

NOTES.

London Electrical Engineers.—Smoking Concert.—The old members of this Corps are holding a re-union smoking concert at Cannon Street Hotel, E.C., on Wednesday, June 2nd, at 7 p.m. Tickets (price 2s. 6d.) may be obtained from the secretary, Mr. T. Franklin, 108, Heathwood Gardens, Charlton, S.E. 7. It is hoped to inaugurate an Old Comrades' Association at the concert.

Electric Vehicles in South America.—A correspondent, writing to the *Times Trade Supplement*, says:—"For town work, especially for heavy haulage, there is great scope for a sound electrical vehicle, as commercial electricity is generally pretty cheap in South America, and electrical vehicles do not demand the skilled handling that petrol or steam vehicles do; further, the running costs, upkeep, &c., must be very low. It is unfortunate so many millions have been sunk in internal combustion machines, as if half the sum had been expended on electrical vehicles, we should probably have no other by now. However, it is now stated that Edison's battery has proved itself a success upon the streets of London and elsewhere, so that there should be a good future for the electrical vehicle in South America, where the use of electricity is extending rapidly."

Faraday House O.S.A. Dinner.—The annual dinner of the Faraday House Old Students' Association is to be held at the Holborn Restaurant, London, W.C. 1, on Tuesday, May 4th, at 6.30 for 7 p.m. Mr. G. Scott Ram, M.I.E.E., H.M. Electrical Inspector of Factories, the President, will be in the chair, and the dinner will be followed by an excellent musical programme. Old students desirous of attending should communicate at once with the Hon. Secretary.

Fatalities.—An employé of the Cork Electric Tramway and Lighting Co., Patrick Noonan, 40, met with a tragic death on the 22nd inst., whilst working in a coal elevator, in which he was caught when the machinery was in motion, and was imprisoned, after the machinery was stopped, for some two hours. Every effort was made to get the unfortunate man out of his terrible position in the elevator, but it became necessary to remove the steel plates before this could be done, and then Noonan was dead.

At an inquest held at South Bank, near Middlesbrough, on Tuesday, respecting the death of A. E. Richardson, aged 29, an electric wireman employed at Messrs. Bolckow, Vaughan & Co.'s steelworks, it was stated that deceased had been laying fresh cable. He apparently began to disconnect a switch running on to which were live wires. Mr. J. Hodges said the cause of the accident was at first a mystery. On the covering of one of the wires, however, two small cuts had been discovered. From marks on the pliers which deceased was using it appeared as though Richardson had been killed by that means. It was remarkable that he should be attempting to disconnect live wires. The most probable explanation was that, in a moment of forgetfulness, he had mistaken the incoming and the outgoing wires. The Factory Inspector raised the question whether deceased was competent to do such work, but employés agreed that it was only ordinary routine work, and not at all technical. The medical evidence was that the burns on Richardson's hand were compatible with electric effects. The Coroner found that the man was competent to do the work, and that death was due to accidental electric shock.

Aero-Engine Efficiency.—An average speed of 109·89 miles per hour was maintained by Lieut. Holthouse and Lieut. Debeer in the 1,000 miles flight between Cape Town and Pretoria, which was accomplished in 9 hours 6 minutes. This speaks well for the efficiency of the British engine and British magnetos which form the propelling unit of the South African aeroplane "Vortreker" which was used for the flight.

Dublin Electricity Official Released from Jail.—Mr. Fred. Allen, secretary, Dublin Corporation Electric Supply Committee, was last week released from Mountjoy Jail, Dublin, on completion of three months' imprisonment, in default of giving bail, for having in his possession Sinn Fein literature, which was found in an election committee-room at Kingstown, with which he was associated. On leaving the prison, Mr. Allen, who was in good health and spirits, was greeted by members of the Corporation and of the electrical department staff.

Water Power.—Committee's Report.—A scheme for the utilisation of the water power of the United Kingdom is contained in the report of the Government Water-Power Resources Committee, which will shortly be published. The Committee's chief recommendation is the creation of a new authority, to be known as the Water Commissioners, as a Department of the Board of Trade, with general powers and functions similar to those of the Electricity Commissioners already appointed. The Committee has divided England and Wales into districts, and calls for the creation of Local Committees in counties, or groups of counties, to arrange for the best use of the water supply in those districts. The Committee concludes that there are large reserves of power in British rivers which have not been utilised.

Appointments Vacant.—Cable jointer (87s. 2d.), mains superintendent (£228, rising to £270), for the City of York Electricity Department; meter mechanician (92s.), for the Borough of Wolverhampton Electrical Engineer's Department; meter tester (94s.), for the Edinburgh Corporation Electricity Supply Department; mechanical maintenance engineer (£300), for the Leigh Corporation. See our advertisement pages to-day.

Seed Electrification.—In order to be in a position to express an opinion from direct personal observation, Messrs. Sutton & Sons, the well-known seedsmen, carried out some experiments at Reading in 1919 with seeds electrified by the Wolfryn process, of which particulars have been given from time to time in our pages. In a report upon the experiments, Mr. Martin H. F. Sutton, F.L.S., states that the following series of trials was carried out:—Seeds of mangold, swede, cattle cabbage, and carrot, were sent for treatment to Mr. H. E. Fry, of Godmanstone, one of the patentees of the Wolfryn process, who returned them in due course. The Wolfryn treatment consists in immersing the seeds in a solution of common salt and water (4 oz. to the gallon), or calcium chloride and water (8 oz. to the gallon), to which an electric current is then applied. The seeds are afterwards dried at a temperature of 100° F., and they are then ready for sowing.

The series of experiments made at Reading included two controls of seeds untreated in any way; seeds treated by the Wolfryn process; seeds unelectrified, but soaked for four hours in a solution of salt and water (4 oz. per gallon), and afterwards dried at a temperature of 100° F.; and seeds unelectrified, but soaked for four hours in a solution of sulphate of ammonia and water (4 oz. per gallon), and subsequently dried at a temperature of 100° F. In each case all the samples of seeds of one subject were drawn from the same bag. Two distinct series of experiments were made:—(1) A germination test under glass; and (2) a field test.

The conclusions come to were with regard to (1) that, notwithstanding the one or two points which seemed to be slightly in favour of the electrified seed, the results obtained by this series of tests, as a whole, could only be regarded as inconclusive; (2) reviewing the outdoor tests as a whole, the results would appear to be no more conclusive than were the tests for germination, the returns from the electrified seed showing no advantage over the other sections, except to a small extent in the case of the mangold crop.

Summer Time in Canada.—Daylight saving is to be generally adopted throughout the Province of Quebec, but according to *The Times* the Canadian and American railways will continue to run to standard time, and probably most Canadian towns and cities will follow the same time as the railways.

The Pasadena Convention.—The American electrical Press is, and has been for some time, full of details of the National Electric Light Association Convention to be held at Pasadena, California, from May 18th to 22nd next. The latest received copy of the Association's *Bulletin* gives a complete programme of events, and the names of the members of the many Committees. The enormous amount of work (and pleasure) to be got through in the short time at the disposal of the Convention will, judging by the programme, tax the American characteristic of "hustle" to the utmost. Every branch of the industry is being dealt with from the generation and distribution of power to the smallest details of salesmanship and finance. Electric vehicles and hydro-electric development are in charge of two special sections. The reader of such a formidable scheme may well wonder where the "auto" rides, golf, and dances, are to come in.

Earthing.—An article in the *Revue Générale de l'Electricité* refers to the lack of precision in official regulations on the earthing of electrical machines and installations, and gives a few practical rules justified by experience. The French rules only deal with the earthing of non-current-carrying parts. The question of earthing windings and live parts is a controversial one, particularly with regard to the earthing of the neutral points of three-phase alternators and transformers. On the other hand, instruments and instrument transformers must have their cores and windings earthed, also arresters, &c. The earthing should be done by means of a copper conductor containing as few bends as possible, of section calculated at 1 sq. mm. per 10 amperes of the normal load current of the apparatus or installation to be protected, with a minimum of 10 sq. mm. This refers only to the earthing of machine frames and parts liable to be traversed by the full short-circuit current. The earth contact should be a sheet of galvanised iron at least 5 mm. thick, or a copper sheet at least 2 mm. thick, placed in a bed of coke breeze 50 cm. thick. If a sheet of water is available, the earth contact may be a metal cable or pipe immersed therein. In either case, the surfaces and lengths must be such that the resistance of the contact shall not exceed $R = 50/I$, I being the maximum short-circuit current, equal in A.C. to $E\sqrt{C/L}$. Therefore, $R < (50/E)\sqrt{L/C}$, L and C being the machine constants. In practice $\sqrt{L/C}$ generally averages 70. We may thus take $R < 3{,}500/E$, with a minimum of about 5 ohms. For direct current, R can be taken as between 5 and 10 ohms. For earthing arresters, the earth wire should be of 50 to 100 sq. mm., and the earth resistance not over 10 ohms.

Electrical Work in Sydney.—Asked at the Municipal Council whether there was any shortness of work for skilled men, such as those engaged in working overtime at the power-house, the Lord Mayor of Sydney, N.S.W., replied:—"I am not aware of any such shortage, and I am advised by the city electrical engineer that there is no shortage of work in Sydney at present for skilled workmen. On the contrary, the city electrical engineer informs me that any employer of skilled labour, if asked, will say that he is short of the number of skilled men which he could usefully employ. Moreover, if the office of a Trade Union of skilled workers is applied to for men, the general answer is that there are no men on the books of the Union out of employment. The city electrical engineer has further reported that in one trade, for instance—that of electrical installation work—several hundred electrical mechanics could be employed immediately if they were available; but every electrical mechanic is already employed."

INSTITUTION NOTES.

Institution of Electrical Engineers.—Arrangements for May, 1920:—*Ordinary Meetings.*—13th: "Permanent Magnets in Theory and Practice," by Mr. S. Evershed. 20th: Annual general meeting.

Territorial Centres.—11th.—Leeds: Annual general meeting.

Students' Section.—14th: Annual general meeting; paper by Mr. E. G. Humfress on "Electrical Motor Control Devices."

The March *Journal* announces that in place of one premium of £10 and several of £5 hitherto awarded each session for papers read before the Students' Sections, the Council has decided to award, in future, three premiums of £15 each. The Council has also accepted an offer from the B.E.A.M.A. of prizes of £10 each (up to a total value of £100 for the first year), for the best papers by students of the Institution on electrical subjects suitable for publication in the B.E.A.M.A. *Journal*.

North-Western Centre.—The eleventh Kelvin lecture on "Modern Marine Problems in Peace and War," was delivered at the Manchester College of Technology by Dr. C. V. Drysdale on April 20th. There was a large attendance.

Mr. J. A. Robertson presided, and in introducing the lecturer, said that in view of the great work which Lord Kelvin did for marine purposes, it was fitting that the subject of this lecture should be associated with his name. No one could question the importance of what was done by Lord Kelvin and by the men who successfully tackled vital problems during the recent war.

North-Eastern Centre.—The annual meeting of the North-Eastern Centre was held on April 19th at Armstrong College, Newcastle-on-Tyne. Mr. W. Cross was in the chair. The annual report of the Committee was submitted. It stated that the membership of the Centre had increased from 291 to 389. The attendance at the meetings had averaged 58. In addition to the ordinary programme of meetings, a special course of lectures upon "The Foundations of the Theory of Electrical Power Transmission" had been given by Prof. Thornton, D.Sc.,D.Eng., to the members of the Centre. The first annual dinner held since the war took place on January 30th, at Newcastle, at which 78 members and guests were present. The Students' Section had held eight meetings during the session, in addition to several visits to works, &c.

The question of rules for the Centre had been given considerable attention by the Committee, and at a special general meeting on February 23rd last the following resolutions were passed relative to the election of future committees:—(1) That the number of ordinary members of committee be limited to 15; (2) that in addition to the retiring committee's nominations, any four persons entitled to vote (members, associate members and associates) may nominate any other duly qualified person to fill any vacancy by delivering such nomination in writing to the Hon. Secretary. The Committee had prepared a full set of rules for the election of officers, and for carrying out the business of the Centre. The draft had been submitted to the Council, which was considering it with a view to issuing a set of regulations, unifying the procedure of the different Territorial Centres.

In order to give adequate attention to the large and varied business which came before the Committee, a number of standing sub-Committees had been appointed, the result of whose work came before the full Committee for confirmation before any action was taken. The sub-Committees at present set up were:—(1) Finance; (2) sessional arrangements; (3) rules; (4) engineers' club; (5) Territorial Centre's improvement; (6) Electricity Supply Bill; (7) Students' Advisory; (8) metric and decimal; (9) wiring rules.

The election of officers resulted as follows:—Chairman, Mr. J. R. Beard, M.Sc.; vice-chairmen, Prof. W. M. Thornton, D.Sc., Messrs. E. Fawcett, T. Carter, and F. G. C. Baldwin; Ordinary Members of Committee—Power Supply Undertakings:—Messrs. R. M. Longman, W. F. T. Pinkney, G. L. Porter, C. Vernier. Manufacturers and Contractors:—Messrs. H. W. Clothier, N. W. Prangnell, T. Carter, A. Collins, J. Rosen. Municipal Engineers:—Mr. E. Moxon. Consulting Engineers:—Mr. C. H. Davison; Mr. R. W. Gregory. Civil Service and Railways:—Mr. G. L. Drury; H. Kitchen. Miscellaneous Sections:—Dr. A. C. Mitchie, D.Sc. Hon. Treasurer:—Mr. W. T. MacCall. Hon. Secretary:—Mr. H. B. Poynder.

The report of the Tees-side Sub-Centre also was read; it stated that they had had nine meetings, and in addition to these, the Committee had arranged for Dr. Thornton to give three lectures. It was suggested that next session an earlier start should be made with the meetings, and, if the necessary support was forthcoming, they should, if possible, be held fortnightly.

Major T. Rich, O.B.E., then delivered a lecture upon "Electricity on the Western Front," which was highly appreciated.

Liverpool Sub-Centre.—The first annual general meeting was held at Liverpool on April 26th, at which the new committee for the session 1920-21 was elected, and the annual report presented. The meeting was followed by a smoking concert. The report states that five general meetings have been held with an average attendance of 106. It is recommended that the Liverpool area should be defined by straight lines between the following towns:—Southport, Prestatyn, Wrexham, Warrington, Wigan, and back to Southport. Southport and Wigan are at present included in the Preston area, but the members are to be invited to decide which sub-Centre they wish to become attached. The total number of members (including students) has increased from 220 in November, 1919, to 294 up to April, 1920.

Birmingham Metallurgical Society.—The subject of "Refractories and the Electric Furnace," was discussed by Mr. P. S. Devereux, before the Society on April 15th. Dealing with the higher refractories, he pointed out that the rapid development and rate of adoption of the electric furnace had been phenomenal, but urged that it was greatly retarded by want of suitable refractories. Only such materials as pure silicon carbide (SiC), fused alumina ($A_1 2O_3$), sintered magnesia (MgO), fused spinel (MgO $A_1 2O_3$), crystalline sillimainte ($A_1 2O_3$ SiO_2), and calcined zirconia (ZRO_2), would meet the excessively high temperatures required, and have at the same time the many other desired heat, strength, and dielectric properties. Which of these refractory materials would be most suitable for a given case would be much more dependent on physical than on chemical conditions, and the desired physical properties could be obtained with greater certainty with such refractories than with such materials as clay, bauxite, or calcined magnesite, in which the physico-chemical reactions were only partially completed in the finished refractory product. Fused alumina was also an electric furnace product being manufactured from bauxite and carbon. The great advantage of bricks made from this material over those made of unfused alumina was the absence of shrinkage combined with high resistance to abrasion and slags. Magnesia spinel (MgO $A_1 2O_3$) did not soften until a temperature of 2,135° C. was attained, its entectics with MgO and $A_1 2O_3$ melting at 2,030 and 1,925° C. respectively. Pure magnesia did not liquefy until a temperature of 2,800° C. was attained. If any quantities of alumina, no matter how small and not exceeding 70 per cent., be mixed with the magnesia, the liquefaction temperature dropped from 2,800 to 2,030° C. By mixing together magnesia and alumina in the proportion of 72 of $A_1 2O_3$ to 28 of magnesia, the compound magnesium aluminate would form even at temperatures considerably below its melting point. Refractories might, added Mr. Devereux, help in the conservation of fuel. In a high temperature furnace or kiln where the internal temperature required was higher than the refractory lining would withstand, it was customary to protect this lining by artificial cooling, either by means of air or water. Such artificial cooling resulted in a great waste of heat, and a corresponding greater consumption of fuel. The ideal arrangement would be to cover the outside of the furnace with a good thermal insulator so as to retain the heat in the furnace. The development of refractory materials which would permit the thermal insulation of industrial furnaces would result in an enormous fuel saving.

Warrington Electrical Society.—The inaugural meeting will be held on Friday, 30th inst., at the Pelican Hotel, Warrington. A comprehensive programme of lectures of an educational nature is being arranged.

Iron and Steel Institute.—Responding to the toast of "Kindred Associations," at the annual dinner of the Staffordshire Iron and Steel Institute, at Dudley, on Saturday, Dr. C. C. Garrard, chairman of the South Midland Centre of the I.E.E., said the electrical engineering trade was indispensable to the iron and steel manufacturer. That was shown during the war, and he believed he was correct in saying that there were installed during the war more electrical rolling mills than the total number that existed before the war. The electrical manufacturer was not getting the number of steel forgings and the like that he wanted, and the future of electrical engineering depended upon his ability to get an adequate supply of these materials. The industry at the present time stood in great danger owing to the scarcity of these essentials, and to the high prices. He had no doubt there were good reasons for the increased prices, but steel plates had gone up four times and forgings for electrical machinery three times. They were being invited by everybody in authority to increase exports, in which direction the question of prices was a very important one. Before the war there was considerable competition from Germany in exports, and now the war was over it was still a very difficult proposition, but the competition had passed from the old world to the new. There was no doubt in his mind that the cost of electrical machinery in America was less than in this country at the present time. The future, he was afraid, was dark. They had the workman continually asking for increased wages in his endeavour to keep up with the increased cost of living, and perhaps they could hardly blame him for that. On the other hand, they had the manufacturer content to go on increasing his prices, not only for iron and steel, inflating his capital to the increased level of prices, and hoping that something would turn up to avert the Nemesis that was in front of them. They had got to increase their exports. Some people thought the Government would provide the solution, but he had little faith in that. He thought it was up the manufacturers themselves. They represented the knowledge, the intelligence, and the experience, and they had got to provide the solution. He thought such Institutes should discuss the commercial as well as the technical side of the matter. They were continually told they must increase production, but they must come forward with concrete proposals. It seemed to him that if manufacturers, engineers, and ironmasters, could get together and appoint Commissions it would be the best way out. The Commissions should consist of the best brains in industry, to suggest how production costs could be decreased. The key of the solution was co-operation, and he was certain it would be best for the country and for themselves. If they did not do this it would be forced upon them either by fast-declining trade or the advent of a Socialist Government, neither of which alternatives they wanted.

Society of Chemical Industry.—On Friday last at a conference of the Chemical Engineering Group of this society at Birmingham University, Mr. H. Blyth read a paper on "Modern High-Speed Electric Telpherage and its Applications in Chemical Works," giving details as to the invention, early application, and development of electrical telpherage in the United Kingdom, with notes on contemporary progress abroad. Mr. H. J. H. King spoke on "Pneumatic Conveying of Coal and Similar Substances"; Captain C. J. Goodwin on "Portable Conveyors and Transporting Trucks"; Mr. Gordon S.

Layton on "Pneumatic Conveying of Granular Substances"; Mr. A. E. Marshall on "The Development and Use of Labour-Saving Devices in the American Chemical Industry"; Mr. H. Varndall on "The Importance of the Mechanical Handling of Material in its Relation to Production Costs." "Automatic Weighing and Filling Machines for Liquids" was the subject of a paper by Mr. H. F. Broadhurst.

Edinburgh Electrical Society.—On April 21st, Mr. J. McEwan Brown, of the Post Office Telephone Service, lectured to the above society on "Telephones." The paper was illustrated by diagrams and apparatus, and dealt chiefly with the development of the telephone. The theory of phantom circuits was explained in an interesting manner, and discussed by the members.

On Saturday, April 24th, the society visited the works of Messrs. Bruce Peebles & Co., Ltd., at East Pilton, and was much impressed with the variety, size, and quantity of the machines in process of building for home and export use.

The annual meeting of the society, which is the last of this session, will be held at the Philosophical Institute on Wednesday, May 12th, when the council will be elected and prizes distributed.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Stepney B.C. Finance and Parliamentary Committee, on the recommendation of the General Purposes, Staff and Education Committee, recommends that in lieu of the inclusive salary now being paid to the borough electrical engineer and manager, Mr. W. C. P. TAPPER, he be paid an inclusive flat rate salary of £1,700 per annum as from April 1st, that the salary be in full discharge of all existing or future bonuses unless and until the cost of living further increases to at least 160 per cent. over pre-war figures as shown by the B.O.T. returns. The salary, according to the scale of the A.E.E. of Great Britain would be £1,705; the present salary of the electrical engineer is £1,200.

Dover Corporation has granted the following increases of salary to officials at the electricity works: Chief engineer, to £520, including £220 bonus; chief assistant engineer, to £400; mains engineer, to £300; all from April 1st last.

The following appointments have been made in connection with the Tasmanian State hydroelectric department. Mr. BUTTERS, the chief engineer and general manager was leaving on a business visit to America and England, and Mr. F. M. Nicholl (who for some years was in charge of electricity stations in England, and afterwards was chief of the Kolar Goldfields) was appointed deputy chief engineer and general manager. Mr. R. Morse was appointed engineer for electrical designs; Mr. F. W. Echlin is supply and transport superintendent; Mr. E. F. Du Rieu was appointed engineer for electrical construction; Mr. C. C. Halkyard will, at an early date, take up the duties of engineer-in-charge of hydraulic designs in addition to present hydraulic designing, estimating, and survey work, so as to free Mr. A. H. Bastow from everything but construction in the field. Mr. Bastow, civil engineer, will relinquish the design side of hydraulic work and concentrate upon construction work.

Captain J. HUNTINGTON has been appointed district manager for Bristol and the South-West of England by Messrs. Simplex Conduits, Ltd. He joined the firm 18 years ago. In the early days of the war he took a commission, saw much active service, was mentioned in despatches, and gazetted captain. He rejoined his old firm in 1919.

Rochdale Corporation Electricity Committee proposes that the salary of the electrical engineer, Mr. F. H. RUDD, be increased from £500 to £700 per annum, with further increases of £50 next year and £50 in 1922. The Tramways Committee recommends that the salary of the general manager, Mr. G. WEBSTER, be increased from £600 to £800 per year.

Mr. J. R. LILLEKER and Mr. C. H. JESSOP, members of the Rotherham Corporation electricity staff, who are leaving, have been presented by their colleagues with a gold watch and a case of Treasury notes respectively.

Mr. C. H. BARRETT, of Wendover, has been appointed mains assistant at the Aylesbury Corporation electricity works.

Mr. T. TURNER has been appointed by the Board of Trade secretary to the Water Power Resources Committee in the place of Mr. R. T. G. French, who will continue to assist in the work of the Committee so far as his new duties as secretary to the Electricity Commission will permit. Mr. Turner's address is: Board of Trade Offices, Great George Street, S.W.1.

Mr. C. T. WILKINSON, London manager of the Milliken Manufacturing Syndicate, has been appointed by President Townley, of the American I.E.E., on the recommendation of Mr. E. B. Meyer, Chairman of the Transmission and Distribution Committee, to membership of that committee, an honour which we believe has not been conferred on any other engineer outside the United States.

Mr. G. M. CHAPMAN has left the War Department employ at Aldershot, where he was a shift engineer, to take up an appointment with a large industrial concern in Kent. Mr. F. PHILP, also until recently employed on the staff at the central electric power station, Aldershot, has entered the service of Winchester Corporation electricity department.

Mr. W. C. CAMERON is leaving the staff of the central electric power station, Aldershot Command, where he has been a shift engineer for the past 14 months, in order to take up a position with the Newcastle-on-Tyne Electric Supply Co.

Mr. A. MARKS has been appointed representative for Messrs. Albert Lee & Co., Ltd., in the Southern and Eastern Counties in the place of Mr. W. P. Kerr, who has been transferred as representative for the North of England.

Will.—The late Mr. R. N. JACKSON, chairman of P. R. Jackson & Co., Ltd., of Salford, left £128,330 gross and £93,178 net personalty.

NEW COMPANIES REGISTERED.

Locomobile Engineering Co., Ltd. (166,717).—Private company. Registered April 21st. Capital, £500 in £1 shares. To carry on the business of general, motor and electrical engineers, blacksmiths, copper and tin smiths, manufacturers of and dealers in motors, &c. The first directors are: G. W. Capewell, 56, Rawcliffe Road, Walton, Liverpool; Fred. Ambler; Frank Ambler, 136, Carisbrooke Road, Walton, Liverpool, motor haulage contractor. Registered office: 444, Eastbourne Street, Alnitree, Liverpool.

Wm. Anderton & Co., Ltd. (166,308).—Private company. Registered April 12th. Capital, £5,000 in £1 shares. To take over the business of electrical engineers, &c., carried on by W., C., and T. Anderton at 16 and 18, Fenney Street and 2, Cornett Street, Higher Broughton, Manchester, and the Promenade, Rhos-on-Sea, North Wales, as "William Anderton & Co." The first directors are: W. Anderton, King's Mount, Rhos Road, Rhos-on-Sea, Colwyn Bay; C. Anderton, Hazel Bank, Singleton Road, Kersal; T. Anderton, Hill Crescent, Singleton Road, Kersal. Solicitor: F. Wills, 22, Booth Street, Manchester.

Spanish and General Corporation, Ltd. (166,682).—Registered April 19th. Capital, £500,000 in £1 shares. To take over the business of the Spanish and General Wireless Trust, Ltd. (in liquidation), to acquire, hold, sell and turn to account shares and securities of any company established in the U.K., the British Colonies or dependencies, Spain or any other foreign country, &c. The first directors are: Godfrey C. Isaacs, Lyne Grove, Virginia Water; Alfonso Marconi, 75, Harley House, Regent's Park, N.W.; Capt. M. H. P. R. Sankey, 57, Castlebar Road, Ealing; S. F. St. Jermain Steadman, 4, Clever Road, N.W.6. Qualification, £100. Remuneration, £200 each per annum, with an additional £300, divided between them, for every 1 per cent. above 5 per cent. distributed as dividend on the ordinary shares. Secretary: H. W. Corby. Solicitors: Coward and Hawksley, Sons and Chance, 30, Mincing Lane, E.C. Registered office: Marconi House, Strand, W.C.

A. Spooner & Co., Ltd. (166,602).—Private company. Registered April 19th. Capital, £1,000 in £1 shares. To carry on the business of electricians, electrical, motor, mechanical, telephone, heating, ventilating, consulting and general engineers, &c. The first directors are: A. Peel, 239, Manchester Road, Nelson; W. Ramsbottom, 34, Rock Mount, Whalley Road, Accrington; J. Ramsbottom, 19, Owen Street, Accrington; A. Spooner, 49, Aitken Street, Accrington. Secretary: W. Ramsbottom. Registered office: 96, Whalley Road, Accrington.

Amalgamated Firms, Ltd. (166,503).—Registered April 16th. Capital, £200,000 in £1 shares. To carry on the business of electricians, accumulator manufacturers, manufacturers of electrical appliances, engineers, suppliers of electricity and electrical machinery, &c. The subscribers (each with one share) are: W. L. Hodges, The Twining, Grove Park, S.E., solicitor; A. Warren, 45, Morley Road, Lewisham, S.E., clerk; and five clerks. Minimum cash subscription, £7. The subscribers are to appoint the first directors. Solicitor: E. C. Simmons, 12, Finch Lane, E.C.

Magstarlite, Ltd. (166,588).—Private company. Registered April 17th. Capital, £2,500 in £1 shares. To take over, as from April 12th, 1920, the undertaking of P. G. Broom and T. Cartledge, trading as the "Magstarlite," and to carry on the business of mechanical and electrical engineers, manufacturers and patentees of magnetos, car lighting sets, dynamos, insulators, accumulators, &c. The first directors are: P. G. Broom, 18, Avonwick Road, Heston, Hounslow; T. Cartledge, 284, Bath Road, Hounslow; H. R. Harris (secretary), 48, Agamemnon Road, West Hampstead. Registered office: 22, Western Broadway, King Street, W.6.

Bennett & Rutherford, Ltd. (11,134).—Private company. Registered in Edinburgh April 14th. Capital, £10,000 in £1 shares. To take over the business of mechanical and electrical engineers, merchants, agents and manufacturers and suppliers of electric current carried on by W. Bennett and R. Simple at 254, West George Street, Glasgow, as "Bennett and Rutherford." The subscribers (each with one share) are: W. Bennett, 254, West George Street, Glasgow, electrical engineer; R. Simple, 179, West George Street, Glasgow, engineer; A. S. Paterson, 254, West George Street, Glasgow, electrical engineer. The first directors are: W. Bennett, R. Simple and A. S. Paterson. Registered office: 254, West George Street, Glasgow.

Kendall & Gent, Ltd. (166,527).—Registered April 16th. Capital, £150,000 in £1 shares. To take over the business of machine tool makers carried on by Kendall & Gent, Ltd., at Victoria Works, Gorton, Manchester. The first directors are: A. H. Baldwin, Southernhay, West Didsbury, Manchester; E. Harper, 12, Sandeleigh Avenue, Withington, Manchester; J. Westall, Cedar Villa, Highfield, Gorton, Manchester; A. Tongue, Da Vince House, Eccles; F. C. Mosley, Crumpsall Grove, Crumpsall, Manchester; C. E. H. Baldwin, Southernhay, West Didsbury, Manchester. Secretary: J. Maguire. Registered office: Victoria Works, Williams Road, Gorton, Manchester.

Telephos, Ltd. (166,495).—Registered April 15th. Capital £30,000 in 35,652 ordinary and 40,000 "A" preference and 44,348 "B" preference shares of 5s. each. To adopt an agreement with the Telephos Domestic and Street Lighting Co., Ltd., and H. H. Foster, the liquidator for the acquisition of certain rights and property referred to therein, to light, extinguish and control at a distance all kinds of gas, to light with gas, electricity or other illuminating means or appliances, roads, streets, houses, shops, buildings, railways and wharves, &c. The first directors are: A. St. J. Cooke, 40a, Hyde Park Gate, S.W.7 (director, Gas and Coke Ovens, Ltd., &c.); Sir James Heath, Bt., Oxenden Hall, Market Harborough (director, English Oilfields, Ltd.); F. W. Wright, 6, Vale Avenue, Chelsea, S.W. (director, Cowie Harbour Coal Co., Ltd.); A. E. Broadberry, Ellersile, Buckhurst Hill, Essex; J. H. Swinson, 44, Oxford Mansions, W. Minimum cash subscription, 7 shares. Secretaries: C. L. Anderson & Co. Registered office: 905-6-0, Salisbury House, E.C.

Turner Brothers Asbestos Co., Ltd. (166,685).—Private company. Registered April 19th. Capital, £100 in £1 shares. To acquire the business of a company of similar name, incorporated in 1899 and now in liquidation, and to carry on the same and any other business for the time being acquired or carried on by this company for the benefit and under the control of Turner & Newall, Ltd., who are the permanent managers. The first directors are: Sir Sam Turner, Chaseley, Rochdale; R. Turner, Denehurst, Rochdale; C. H. Turner, Falinge Corner, Rochdale; S. Turner, jun., Spring Bank, Bamford, Rochdale; R. H. Turner, Thrum Hall, Rochdale (all directors of Turner, Newall & Co., Ltd., Samuel Turner & Co., Ltd., and Asbestos and Electrical Fittings Co., Ltd.). Solicitors: Jackson & Co., Rochdale. Secretary: H. S. Howorth. Registered office: Woodland Road, Spotland, Rochdale.

Newall's Insulation Co., Ltd. (166,700).—Private company. Registered April 19th. Capital, £100 in £1 shares. To acquire the business of a company of same name, incorporated in 1908 and now in liquidation, and to carry on the same and any other business for the time being acquired or carried on by this company for the benefit and under the control of Turner & Newall, Ltd., who are the permanent managers. The first directors are: F. S. Newall, Castle Hill, Wylam, Northumberland; G. S. Newall, Sunniside, Hexham, Northumberland; N. D. Newall, Low Warden, Hexham, Northumberland; M. Robson, The Cedars, Lyndhurst Road, Benton, Northumberland. The two first named are directors of the Washington Chemical Co., Ltd., and Turner & Newall, Ltd., and F. S. Newall is also a director of various electrical and other companies. Registered office: Woodland Road, Spotland, Rochdale.

Coventry Automatic Telephones, Ltd. (166,752).—Private company. Registered April 23rd. Capital, £60,000 in £1 shares. To acquire the benefit of certain inventions relating to automatic telephone systems, exchanges or apparatus, to adopt agreements (1) with the North Electric Manufacturing Co., of Galion, Ohio, U.S.A., F. R. McBerty and K. B. Miller, and (2) with the General Electric Co., Ltd., Peel-Conner Telephone Works, Ltd., and M. S. Conner; to carry on (with due regard in the U.K. to any exclusive or other rights for the time being vested in H.M. Postmaster-General) the business of a telephone, telegraph and electric light, heat and power supply company, controllers of telephone exchanges, &c. Nominated directors: M. S. Conner, Copsewood, Grange Stoke, Coventry; J. Fraser, 31, Copthall Avenue, E.C.; H. P. Wells, 67, Queen Victoria Street, E.C.; F. R. McBerty, Galion, Ohio, U.S.A.; K. B. Miller, Galion, Ohio, U.S.A. M. S. Conner, J. Fraser and H. P. Wells and any directors appointed in their places by the General Electric Co., Ltd., are permanent. F. R. McBerty and K. B. Miller and any directors appointed in their places by the North Electric Manufacturing Co. may hold office so long as that company retains £7,500 ordinary shares. Secretary: P. P. Kipping. Registered office: 71a, Queen Victoria Street, E.C.

F. W. Bland & Co., Ltd. (166,755).—Private company. Registered April 23rd. Capital, £5,000 in £1 shares. To take over the business of an electrical and mechanical engineer carried on by F. W. Bland at 68, Crosby Street, Maryport, Cumberland, as "F. W. Bland." The first directors are: F. W. Bland (permanent managing director), 27, Coronation Street, Maryport; R. B. Ritson, Kirkby House, Maryport; R. Ferguson, 14, Church Street, Maryport; E. Prior, 13, Curzon Street, Maryport. Qualification, £50. Secretary: E. Prior. Registered office: 68, Crosby Street, Maryport.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Woodbridge and District Electric Light Co., Ltd.—Particulars of £7,500 debentures created February 9th, 1920. Present issue £50. Property charged: the company's undertaking and property, present and future, including uncalled capital. No trustees.

Trafford Power and Light Supply (1902), Ltd.—Satisfaction in full of debentures dated June 28th, 1915, and June 10th, 1918, securing £15,000 and £50,000 respectively.

Herne Bay Gas and Electricity Co., Ltd.—Mortgage or charge, by way of resolution, dated August 19th, 1911, to secure £9,500 debenture stock charged on company's undertaking. No trustees. (Registered April 16th, 1920, pursuant to Order of Court.)

New Trafford Engineering Co., Ltd.—First mortgage debenture dated April 8th, 1920, to secure £15,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: D. A. Prosser and C. M. Jeram, 190-2, Portland Street, W.

Premier Electric Welding Co. (Swansea), Ltd. (166,422).—Private company. Registered April 14th. Capital, £20,000 in £1 shares. To carry on the business indicated by the title. The subscribers (each with one share) are: J. G. de C. Coke, Bank Buildings, St. James Street, S.W.; A. L. Haggerty, Bank Buildings, St. James Street, S.W. The subscribers are to appoint the first directors. Solicitors: Bircham & Co., 46, Parliament Street, S.W.

James Scott, Ltd.—Equitable mortgage charged on certain freehold land and premises at Knowsley Road, Bootle, Lancs., dated March 22nd, 1920, to secure all moneys due or to become due from company to Bank of Liverpool and Martins, Ltd., not exceeding £13,000.

Electrical Apparatus Co., Ltd.—Mortgage dated March 31st, 1920, to secure all moneys due or to become due from company to London Joint City and Midland Bank, Ltd., charged on Vauxhall Works, South Lambeth Road, S.W.

Staffordshire Electrical Accessories Co., Ltd.—Debenture dated April 8th, 1920, to secure £1,735 charged on company's undertaking and property, including uncalled capital. Holders: H. F. Howells, 40, Lichfield Street, Hanley.

Fredk. R. Butt & Co., Ltd.—Charge on 10, Devonshire Grove, Old Kent Road, S.E., dated April 8th, 1920, to secure all moneys due or to become due from company to London Joint City and Midland Bank, Ltd.

CITY NOTES.

Brush Electrical Engineering Co., Ltd.

Mr. E. Garcke presided at the annual meeting on Monday. He said that the balance sheet showed a further substantial improvement in the position of the company. The gross profit amounted to £227,466, compared with £159,254 in the preceding year. The general charges had increased from £22,829 to £25,852. The net profits were £148,685, an increase of £57,687. He wished to repeat a statement that he made at the last meeting when he said that if in future they were able to declare dividends at what might be regarded as high rates, it should be borne in mind that the capital was small in relation to the size of the undertaking, and the volume of business now done. It was a small capital because it was written down drastically at a time when it was impossible to earn profits in this country by the manufacture of electrical apparatus because of the legislative and fiscal conditions then obtaining. The sum of £85,000 which they were carrying forward might appear large, but they had to provide for excess profits duty. The output from the works during the year under review had been large in both the rolling stock and the engineering departments, and the amount of work in hand and the number of orders flowing in were considerable. The improvement in the business was due mainly to the development of their standard lines of manufacture, and only to a small extent to residual war orders. Immediately on the signing of the armistice in November, 1918, they took in hand the change over from the production of war material on which they were then exclusively engaged, to industrial work, with the result that they were quickly in a position to resume their normal manufactures. Such extensions as they were able to carry out during the war had been adapted as far as possible for the purposes of their normal business, but they had proved to be quite insufficient to meet the increasing demands made upon them. During 1919 they had increased their capacity for building railway, tramway, and other rolling stock, and they were still improving and adding to their facilities in that department. On the engineering side there had been great development in the orders for Brush-Ljungstrom turbo alternators and auxiliaries, and the demand for that plant was now only limited by their capacity to supply. The orders received this year exceeded by more than 75 per cent. those for the corresponding period of 1919, and already they amounted to more than half the total for the whole of that year, which was in itself a record year. After careful consideration of the whole situation, the directors had authorised the erection of a large additional factory to be devoted to the economical production of Brush-Ljungstrom electrical power sets. The transformer branch of the business had also grown very much, and they had put up a large new shop to help their production of transformers, which they hoped would be in full operation in the course of the next three or four months. Additional buildings and plant were of little use if they were not able to command sufficient labour and they were experiencing great difficulty in attracting workmen and their families because of the lack of housing facilities. That was a very real difficulty at Loughborough, and it was clear that they must help themselves if they were to derive early benefit from the extensions they had in hand. To that end they had acquired a suitable site of six acres near the works on which they proposed to erect a substantial number of houses to meet their more pressing requirements. They had been much handicapped by labour unrest, and the continual advance in wages and materials. The uncertainties as to labour conditions and as to cost affected their contracts seriously. They, of course, covered themselves as far as they could against those contingencies, but it was not satisfactory either to themselves or their customers not to be able to carry out their contracts at firm prices, and it was to be hoped that more settled conditions would soon be established in order to permit of the resumption of normal terms of contract. The moulders' strike had been far-reaching in its effects on production, which had also suffered by the general shortage of labour and by the stand taken by the trade unions against overtime being worked except in cases of special urgency. All their various extensions to factory and other buildings, plant, and tools obviously called for more capital, and the increase in the volume of business also required a larger working capital. They had, therefore, decided to increase the authorised capital of the company from £253,000 to £600,000. That would take the form of ordinary shares, and arrangements for the issue were now under consideration. In making the issue, the interests of the existing shareholders, both ordinary and debenture stockholders, would be protected, in the sense that applications from them would receive preferential consideration in the allotment of the new shares. In view, however, of the fact that some of the company's profits had from time to time been carried to a general reserve fund and spent on extensions, or otherwise employed in the business, and more especially in view of the heavy writing down of the capital in former years, the directors thought it only right before making any new capital issue and admitting new shareholders into a participation in the profits, that the bulk of the general reserve fund should be capitalised and distributed on a cent. per cent. basis to the holders of the existing ordinary stock. As to the future, it was full of hope for them. Some years ago when the company was in dire distress, the board took off their coats and put their shoulders to the wheel with a determination to get the cart out of the mire. It was a heavy task, and took a long time, but it had been accomplished, and they felt satisfied that they were now on the high road to prosperity, and that with the recollection of past adversity deeply rooted in their minds, they had good guarantee that in the future they would keep to the centre of the road.

Subsequently an extraordinary general meeting was held, at which a resolution was agreed to empowering the board to capitalise part of the undivided profits of the company.

Bromley (Kent) Electric Light and Power Co., Ltd.

Mr. F. E. Gripper presided at the recent annual meeting. He referred to the substantial improvement over the previous year. Costs had risen, but there had been a decided increase in output and consumption. There was a considerable number of new consumers, and the wiring department had been busy during the whole of the period. The result of removal of rationing would be shown more fully during 1920. They obtained authority for the maximum rate to be increased from 8d. to 9d., but the additional charge was only in force for three months of the year. During the past few years they had been unable to make substantial provision for the reserve fund. On coming to renew the plant, &c., the cost would be double what was on the books at the present time. Bulk supply was to be taken from the West Kent Power Co. to supplement their own. A supplementary supply would be an advantage, and would save additional expenditure that they would otherwise have to deal with before long.

Vickers, Ltd.

Mr. Douglas Vickers, M.P., presided at the annual meeting, held at Sheffield on 22nd inst. He referred to the acquisition since the last meeting of the Metropolitan Wagon & Carriage Co., Taylor Bros. & Co., and W. T. Glover & Co. He briefly mentioned the new industries that they had taken up to replace the production of armaments, and to the purchase jointly with the Metropolitan Co. of the controlling interest in the British Westinghouse Co., with its connections in France and Italy. The name was subsequently changed to the Metropolitan-Vickers Electrical Co. Relations with the American Westinghouse Co., however, still continued on the most intimate and friendly lines, and further connections had been made with Brown, Boveri & Co., the well-known Swiss electrical firm. With this combination they would have the benefit of a world-wide experience in the design of a large range of materials which had been proved to suit both European practice and that of other countries. The electrical works of the company were very full of work, and the present prospects were excellent. Sheffield works would share, as certain sections of the material will be made there. As far as Vickers' other interests were concerned, the Barrow works had been extremely busy with shipbuilding, and they had every reason to suppose that they would continue to be so for some time to come. Contracts for a term of years had been made with the Cunard and other companies. The first of the Cunarders had been launched, and another one had been laid down. The Barrow works was also building a large number of oil tankers, fitted with internal combustion engines of their own type. On the engineering side of these works also they were repairing and reboilering a large number of locomotive engines, and were making several different types of machinery, so that this section also was well provided with work. The company's Crayford works were increasing their output of sewing machines satisfactorily, and were also helping the Wolseley Co. by manufacturing certain standard motor-car elements for them. The firm's works at Ipswich had been transferred to a subsidiary company, formed jointly with Petters, Ltd., for the manufacture of medium-sized internal combustion engines. These works were very busy. The number of workmen employed by the firm had decreased very much from that employed during the war, which, at one time, rose to 107,000 in the company's factories, including the Wolseley Co. It had now got down to about 44,000, of which 3,600 were women. These figures did not include the Metropolitan Co., Taylor Bros., Glovers, or Metropolitan-Vickers' interests. Taking the year as a whole, it had been one of extreme difficulty, due to changes in trade, shortage of materials, reduction in working hours, and repeated increases in wages. For a long time customers held off, thinking that prices would go down, and they were late in realising that there was no prospect of this for some time to come. Manufacturers also were unable to quote firm prices for work of any magnitude, owing to the continued rises of wages and materials. In addition to this, there was an almost universal restless spirit, and in many branches the output was at first very low. The year ended unfortunately with the moulders' strike, which lasted many weeks, and, in the end, was throwing many of the firm's engineers out of employment through want of machining material. Happily, this strike ended early this year, and the general opinion was that there was a marked improvement in the spirit of the workers among all classes, and it appeared as if 1920 was proceeding, and likely to continue, under very much more satisfactory conditions. The speaker alluded in some detail to their continued inability to publish the accounts. Some negotiations with the Government were outstanding even for 1916. The negotiations were proceeding amicably, and they had no reason to suppose that they would not be fairly treated.

Bath Electric Tramways, Ltd.

Mr. J. B. Hamilton presided at the annual meeting, in London, last week. He said that like all statutory undertakings they had had a difficult year. They had been helped by the fine weather. Owing to this fact and to their being able in April last year to obtain powers to increase fares the total revenue had been increased by £37,344 to £100,000. The expenses increased by £34,035, leaving an excess surplus over the previous year of £3,300, but they were bound to deduct the cost of some renewals. Their increase in fares was made under a temporary Act. After referring to the wage and hours of labour demands, and to meetings that were taking place last week in regard to such demands, the speaker said that a further Act to keep alive the previous increase in charges and extend its powers had passed second reading in the House of Commons, and if passed the directors hoped to place the position before the Ministry so that their petition would be granted. The undertaking had been in operation for 16 to 17 years, and within the next two or three years—perhaps earlier—they would have to spend upon the track sums equal to 2½ times what it cost to lay the original track. On this account he would not be satisfied until they had doubled the amount of £45,000 standing to the contingencies and renewals account. Another reason for not paying the dividend on the preferred ordinary shares was to be found in the terms of their Act regarding higher fares. The directors contemplated the formation of a subsidiary company to take over the motor omnibus and char-à-banc business. If they did so the shares would be offered in the first instance to the shareholders of Bath Tramways, Ltd. The motor company would pay a considerable portion of the capital in cash to the tramway which would have the necessary funds to carry out the necessary renewals.

British Electric Transformer Co., Ltd.

Mr. A. F. Berry presided at the annual meeting on April 20th. He said that they had carried out large extensions to the buildings at Hayes, and purchased freehold land for future developments. The gross profit on trading had increased by nearly £28,000. The profit was over 70 per cent. more than that of the previous year—the issued capital had been increased by over 60 per cent.—and the position disclosed in the accounts was highly satisfactory. Referring to the dividend of 10 per cent., and bonus of 2½ per cent. on the ordinary shares, he said he hoped it might be possible, when the company got well into its post-war stride, to do something still better for the ordinary shareholders, who had so willingly agreed to improve the fixed preference dividend. In regard to the new issue of capital, he said that shareholders sometimes felt that they alone should be given an opportunity of taking further shares, and those holding shares in this company would undoubtedly feel that the present opportunity was even better than that which the directors were able to afford for investment last year, but the directors desired as large a body of shareholders as possible, and were particularly interested to receive the applications of those who were in any way connected with the electrical, engineering, or allied industries, as such shareholders, particularly the small active ones, could and did help them in their business, to which they lent considerable strength. So far as could be seen, it would not be necessary to issue any further shares for some time to come. Replying to a question by a shareholder, the chairman said that in connection with the transformer business they were inundated with orders from all over the world. They had orders booked to the absolute limit of their present producing power, and saw no limit to the demand for their product. They had practically completed the building operations which they determined upon and started as soon as possible after the armistice. The issue they were making was a large one, namely, £325,000, and the directors considered it was a wise policy, particularly in these times, to have it underwritten, especially as the issuing house were very nearly presenting the company with their services.

English Electric Co., Ltd.

The first annual report (1919) states that the balance to the credit of profit and loss account (including certain undistributed profits on subsidiary companies at January 1st, 1919) is £410,835. Debenture interest and trustees' fees absorb £23,943; expenses of debenture issue, £115,660; preliminary expenses, £17,385; transfer to capital reserve, £100,000; preference dividend 6 per cent., less tax, £79,842; balance to carry forward £45,302. The company is, for the time being, a holding one, deriving its profits in the main from dividends on shares from its subsidiary companies. It has always been, and still is, the intention of the directors to consolidate the different constituents into one manufacturing entity, but the process is slow, especially at the present time. During the greater part of the year under review the several works were occupied in the conversion of the plant from war conditions to those suitable for commercial requirements. As this company owns the whole of the shares of the Coventry Ordnance Works, Ltd., and the Phœnix Dynamo Manufacturing Co., Ltd., the directors have been able to transfer from these companies sufficient of their undivided profits at January 1st, 1919, to permit of the writing-off of the whole of the discount on, and expenses of, the debenture issue, and of the preliminary expenses of the company, as well as the setting aside of £100,000 to capital reserve account. During the year, negotiations for the purchase of the Siemens Dynamo Works at Stafford were brought to a satisfactory conclusion, but as possession was obtained only at the beginning of December, no profits have been taken in from that source. Since the beginning of 1920, an opportunity has occurred for the disposal of the Scotstoun works belonging to the Coventry Ordnance Co. on terms which the directors consider satisfactory. The works, therefore, now controlled and operated by the English Electric Co.

are as follows: Dick, Kerr Works, Preston; Ordnance Works, Coventry; Phœnix Works, Bradford; Siemens Works, Stafford, and Willans Works, Rugby, and the products cover all classes of electrical and allied machinery. The moulders' strike has materially reduced output, and its effects are still hampering production. The position of the company's order book is good, and the directors hope that, given the absence of further labour disorganisation, satisfactory results will be realised. During the year Sir John A. F. Aspinall and Lord Meston joined the board.

French Companies.

The Société des Cables Electriques has declared a dividend at the rate of 64.70 frs. per ordinary share for 1919, founder shares receiving 284 frs. each.

The Société Anonyme pour la Fabrication des Appareils de Chauffage par l'Electricité, whose general meeting was held recently at Lyons, decided to pay a dividend of 70 frs. net per share.

The Société Centrale pour Industrie Electrique reports net profits of 1,049,000 frs. in 1919, as contrasted with 888,000 frs. in the previous year. A dividend at the rate of 25 frs. per share has been sanctioned, being the same as in 1918.

The Société Francaise des Electrodes reports gross profits, excluding the balance forward, of 1,590,000 frs. for 1919, as compared with 1,033,000 frs. in the previous year. It is proposed to pay a dividend of 40 frs. per share, or at the rate of 8 per cent.

German Companies.

The accounts of *Julius Pintsch A.G., of* Berlin, after making provision for depreciation, show net profits of 2,952,000 marks for 1919, as compared with 1,889,000 marks in the previous year. The directors recommend a dividend at the rate of 15 per cent., this contrasting with 10 per cent., and a bonus of 47 marks per share in 1918.

The Treuhand Bank fur Elektrische Industrie, of Berlin, which belongs to the group of the A.E.G., and the Felten and Guilleaume Co., reports net profits of 948,000 marks for 1919, after having written off 1,139,000 marks for losses through depreciation of securities. It is proposed to pay a dividend of 6 per cent., as compared with no distribution in 1918, on a paid-up capital of 13,750,000 marks.

The directors of the *Hamburg Hochbahn A.G.* recommend for 1919 a dividend at the rate of 1¼ per cent. on the "A" shares, and ½ per cent. on the "B" shares, these contrasting with 6 and 5 per cent. respectively in 1918. The guarantee of the State of Hamburg, however, raises the rate on the "A" shares to 5 per cent. The net profits are returned at 764,000 marks, as compared with 2,289,000 marks in 1918.

The report of the *Land und Seekabelwerke A.G., of Cologne-Nippes*, states that the degree of activity in 1919 was favourable and the working results satisfactory. After setting aside 95,000 marks for depreciation as against 562,000 marks in 1918, the accounts show net profits of 1,038,000 marks, as compared with 824,00 marks, and a dividend of 15 per cent. is proposed, this contrasting with 12 per cent. in 1918. The stock of orders brought over into 1920 is said to be good, and to have since been maintained on a favourable level.

The report of the *Robert Bosch A.G., of Stuttgart*, dealing with the third financial year, ended on September 30th, 1919, states that the transition from war work to ordinary manufactures was completed, but despite the increase in sale prices the value of the turnover was not inconsiderably less than in the preceding year. A considerable loss was incurred by the sale offices in Frankfort, Vienna, and Buda Pesth, but only that of the first mentioned affected the balance sheet, as the losses in the other two cases concerned the independent balance sheet of the Vienna company. The sale offices at Geneva and Milan had been reopened, but it had not yet been possible to resume direct relations with England, France, and Belgium. The directors recommend the issue of a loan for 12,000,000 marks, and an increase of 8,000,000 marks in the share capital to 20,000,000 marks. It is, however, suggested that the augmentations in the latter should proceed gradually, and shares for 2,000,000 marks be issued as a first instalment. The net profits in 1918-19 amount to 2,919,000 marks, as against 3,799,000 marks in the preceding year, and it is recommended that instead of paying a dividend the sum of 1,200,000 marks should be credited to the shareholders, corresponding to a dividend of 10 per cent., as part payment for the first instalment of new shares for 2,000,000 marks, leaving the shareholders to pay 800,000 marks to complete the transaction. No dividend was paid for 1917-18, as three-fourths of the net profits were transferred to the taxation reserve fund.

Stock Exchange Notices.—The Committee has ordered the undermentioned to be officially quoted:—

Underground Electric Railways Co. of London, Ltd.—267 "A" ordinary shares of 1s. each, fully paid (Nos. 1,198,711 to 1,198,977).

Oriental Telephone and Electric Co., Ltd.—Final dividends of 3 per cent., less income tax, on the preference shares, making 6 per cent. for 1919, and of 6 per cent. on the ordinary (free of income tax), making 10 per cent. for the year; also a bonus of 2 per cent. on the ordinary, free of tax.

Erinoid, Ltd.—Interim dividend of 15 per cent. per annum for the half-year.

Folkestone Electricity Supply Co., Ltd.—The report for 1919 states that the equivalent of 13,330 8-c.p. lamps were connected during the year (the largest increase in any year since 1913), making the total 181,827. Price of current advanced to 8d. from beginning of 1919; receipts show substantial increase, but cost of fuel, &c., has continued to increase. The higher charges were authorised under the provisions of the Statutory Undertakings Act, and one of the provisions was that the company might pay a dividend of not more than 4½ per cent. per annum on the ordinary capital. The profit on revenue accounts from the three undertakings was £14,302, plus £965 brought forward. Interest on debenture stock and preference dividend are provided for, £7,703 is carried to depreciation, 4½ per cent. (less income tax) is recommended on the ordinary shares, leaving £939 to carry forward. A note is attached to the report stating: "The payment of the dividend recommended is subject to the consent of the Electricity Commissioners, which has not been obtained at the time of issue of this report."

River Plate Electricity Co.—The *Times* states that the board consider that a part of the general reserve may properly be capitalised and divided among ordinary stockholders, and they will submit the necessary resolution at the general meeting to enable them forthwith to allot and issue seven fully-paid ordinary shares of £1 each for each £10 of ordinary stock held. In their report for 1919 (according to the *Financial Times*) the directors say that the improvement in revenue has been materially helped by an exceptional profit on exchange account, due to the large premium on cash remittances from the Argentine to this country. The net revenue for the year, after providing for administration expenses, bad debts, and depreciations, amounts to £57,791, which, with £17,612 brought forward, makes £75,403. The board recommends a dividend of 7 per cent. for the year on the ordinary stock, placing to general reserve £40,000, and carrying forward £4,152.

Bristol Tramways & Carriage Co., Ltd.—Revenue for 1919 £848,050; working and general expenses and renewals £772,430; net revenue (including balance brought forward) £90,319. Debenture and other interest £22,575; interest (carried to reserve) on uninvested portion of reserve fund £6,486; 4 per cent. preference dividend (subject to tax) £14,000; dividend on ordinary shares 7 per cent. for the year, £35,000; carried forward £12,258. The receipts of the tramways department showed an increase of £56,992, and those of the carriage department an increase of £36,142. Passengers carried 72,838,076, an increase of 11,024,952. The Minister of Transport declined to accede to the Corporation's application for a further extension of time for the exercise of its option to purchase. Mr. C. Challenger, after 40 years' service, and for reasons of ill-health, resigned the managership. He will join the board. Lieut.-Col. S. E. Smith has been appointed manager.

Johnson & Phillips, Ltd.—The profit for 1919 on trading accounts, &c., after providing for bad and doubtful debts and charging to revenue upwards of £27,000 for maintenance of buildings, plant, &c., is £89,965, plus £38,832 brought forward, less the dividend paid in May, 1919, £17,500, and 1 per cent. debenture bonus £822. There are deducted: Directors', &c., remuneration, £1,521; debenture stock interest, £4,109; debenture sinking fund reserve, £8,781; interest on second debentures, £2,500; depreciation on machinery and plant, £12,198; interest on loans, £1,195; income tax and excess profits duty, £16,376; leaving £63,795. A dividend of 12½ per cent. per annum, less tax, on the 350,000 ordinary shares requires £30,625, leaving to carry forward, subject to excess profits duty for 1919, £33,170.

Prospectus.—Low Temperature Carbonisation, Ltd.—An issue of 200,000 ordinary shares of £1 each at par is being offered to the shareholders. A contract has been made with the Yorkshire Electric Power Co. at Barnsley for the supply of power gas, and with the Rotherham firm of Steel, Peech and Tozer, Ltd., for the supply of gas for use in steel making, boiler firing, and other purposes. It is proposed to form a subsidiary company to acquire the benefit of these contracts and to obtain from the parent company the sole licence to use its patented processes in the County of Yorkshire.

Eastern Telegraph Co., Ltd.—The report cannot be issued during May owing to unavoidable delays in obtaining returns from stations abroad. Final dividend on the ordinary shares for 1919, 5½ per cent., free of tax, making a total of 10 per cent. for the year. The usual distribution at the rate of 3½ per cent. per annum, less tax, on the preference stock for the first quarter of 1920, is announced.

Montreal Companies.—Montreal Light, Heat & Power Consolidated has declared a dividend of 1½ per cent. for the quarter ended April. On the stock of the Montreal Light, Heat & Power Co. the dividend for the same quarter is 2 per cent.

Lima Light, Power & Tramways Co.—Dividend of 2 per cent.

Kaministiquia Power Co.—Dividend 2 per cent., less tax, for the quarter.

Hydro-Electric Power and Metallurgical Co.—A cable received from the company at Melbourne states that the works started full capacity on March 27th.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—Final dividend for 1919 5½ per cent., making 10 per cent., free of tax, as against 8 per cent. for 1918.

Merthyr Electric Traction & Lighting Co., Ltd.—After putting £1,200 to reserve, and paying 6 per cent. on the ordinary shares, £581 is carried forward.

STOCKS AND SHARES.

TUESDAY EVENING.

STOCK EXCHANGE markets in the main continue dull to heavy. There is not much to make them otherwise. Taxation lies like a blanket over companies and individuals alike. New enterprise is likely to be hard hit by the Budget proposals. Shares in manufacturing companies of all classes are no longer the eagerly-sought investments by all classes. It is the day once more of gilt-edged stocks, which are being absorbed by the same people who, a couple of months ago, were ardently pursuing the industrial boom checked, now, by Bank Rate, Budget, labour, foreign politics, *et hos genus omne*.

Severe shrinkages are shown in the prices of the Underground Railways group. Underground £10 shares are 12s. 6d. lower at 40s., the A shares have dropped a florin to 5s., and the income bonds shed 6½ points to 61½. There has been a good deal of pressure to sell, and the market in the Stock Exchange, reluctant to take stock forced upon it, put down the prices heavily. Until the company is granted Parliamentary powers to raise fares, it is feared that even the 4 per cent. dividend on the income bonds may be further reduced. Metropolitans are down 1 to 19½, and Districts dropped to 17½.

Would-be sellers complain, with some show of reason, of the difficulties attendant upon present-day realisations. As one instance Indo-Europeans may be cited. The middle price is 40, but shares changed hands the other day at 35. Anglo-American Telegraph preferred is another case in point. Although the nominal price is about 77½, a seller had to take 75½ a few days back. In many other stocks and shares it is not always easy to find a buyer at all, and dealings relapse into that uncomfortable state known as a "matter of negociation."

What has happened in the financial world is the unexpected interference of dear money and increased taxation with the speculative spirit that certainly overleapt the bounds of prudence and of national advantage. The new issues that rushed out ahead of the Budget were subscribed to some appreciable extent by people whose object in applying was simply to scalp a profit; permanent investment in the shares was far from their intentions. Having to take up the shares and pay the calls, financial assistance has to be obtained if there are no buyers in the market, and this all helps to aggravate the monetary stringency. While the profound disappointment in connection with the Excess Profits Duty is having a direct effect upon such shares as many of those comprised in our own lists.

British Aluminium ordinary at 21s. 3d. are about 2s. lower, and so are Electric Constructions at the same price. Edison Swan's lost their gain of a week ago, reverting to 22s. 6d. General Electrics keep their quotations with firmness. The company can claim to be in the van of the many which, nowadays, are raising the rates of dividend on their preference shares. Callenders, it may be recalled, acted similarly, and at the present time hardly a day passes without furnishing fresh examples of this latest development of financial fashion. The suggestions are usually passed with an amount of agreement that seems a little surprising.

The River Plate Electricity Company is taking steps to increase its capital, and proposes to issue, as a bonus, 70 per cent. new shares for £100 ordinary stock now held. The price of the latter has accordingly risen 20 points to 170. Para Electric Railways and Lighting shares are being dealt in this week for the first time in their £1 shape, and the ordinary are quoted 13s., the preference 17s. The Bombay Electric Supply and Tramways Company offers new ordinary shares to its proprietors, and although the old shares stand at 115 ex rights, a premium, that is, of 100 guineas, the premium on the new is called about £40. The preference shares are now 15 ex rights.

City Lights have receded to 12½ and County of London ordinary to 9. Westminsters are lower at 5½. Metropolitans have receded to 3½. City preference rallied to 9, at which they appear fully-valued as compared with many other investments now offering. Proprietors of preference shares in various companies will doubtless be on the look-out for additions to be made to their dividends on lines carried into effect by others. The electric supply share market suffers with the rest in the disappointment felt at the Government's decision in regard to the Excess Profits Duty; besides which there is the threatened big rise in the price of coal that renders people nervous of entrusting their money to any industry likely to be sharply affected by the state of the coal outlook.

Subscription lists were due to be closed on Wednesday in this week for the sale of 137,500 seven per cent. cumulative preference shares of £1 each at 17s. 6d. and of 162,500 ordinary shares of £1 each at 2½s. in the British Electric Transformer Co., Ltd. The prospectus stated that preferential treatment in allotment would be accorded to applications for an equal number of both classes of shares, and from shareholders in the company. Profits for the nine years 1911-1919 inclusive were set out in the "offer for sale," but no independent statement of assets and liabilities was given, although the auditors certify that according to the balance sheet dated December 31st last there was a surplus of assets over liabilities, excluding patents and goodwill, of £351,680, subject to payment of the final dividend for 1919.

Foreign issues are weaker again. Mexican, Argentine and Brazilian shares and bonds have fallen. British Columbia Electrics are better. In the cable list, Indo Europeans have lost 90s., Anglo-American preferred a couple of points, West India and Panama fell back to 16s. 3d., Marconis firmed up a little. Certificates of some of the new Radio Corporation shares (the old American Marconis) are beginning to arrive in this country, and dealings may start again towards the end of the week. Brush ordinary has gained 10 at 130. English Electrics are somewhat heavy at 22s. 6d.; the 8 per cent. dividend is not up to all expectations. India-Rubber shares fell back to 13½. Rubber shares weakened on E.P.D. apprehensions, but the produce is a rather better market than of late.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1918.	Dividend 1919.	Price April 27, 1920.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	8	12	6½	—	£9 4 8
Charing Cross Ordinary	4	7	8¾	—	9 0 8
do. do. do 4½ Pref.	4½	4½	9¼	—	8 8 8
Chelsea	3	4	5	—	6 3 4
City of London	8	10	12½	— ¼	8 5 0
do. do. 6 per cent. Pref.	6	6	9	+ ¼	6 13 4
County of London	7	8	9	— ½	8 17 10
do do. 6 per cent. Pref.	6	6	8¾	—	6 17 2
Kensington Ordinary	6	7	8	—	7 0 0
London Electric	Nil	2½	1⅜	—	5 2 6
do. do. 6 per cent. Pref.	6	6	8½	—	9 4 8
Metropolitan	5	6	8¾	— ¼	6 17 10
do. 4½ per cent. Pref.	4½	4½	3¼	—	8 0 0
St. James' and Pall Mall	10	12	6⅜	—	8 16 10
South London	5	6	9⅜	—	7 12 8
South Metropolitan Pref.	7	7	18/9	—	7 0 0
Westminster Ordinary	8	10	5½	— ¼	9 10 6
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	77½	—2	7 14 10
do. Def.	22/6	1½	18½	—	8 0 0
Chile Telephone	6	6	6¾	—	*4 13 2
Cuba Sub. Ord.	7	7	10	—	*7 0 0
Eastern Extension	8	10	15½	—	*6 9 1
Eastern Tel. Ord.	8	10	16⅜	— ¼	*6 5 0
Globe Tel. and T. Ord.	8	10	15⅜	—	*6 7 0
do. do. Pref.	6	8	9	—	6 13 4
Great Northern Tel.	22	—	22½	—	9 15 6
Indo-European	13	10	40	—4½	6 5 0
Marconi	25	—	8⅜	— ⅛	6 13 4
Oriental Telephone Ord.	10	—	2½	—	8 11 6
United R. Plate Tel.	8	—	7⅛	—	*5 1 7
West India and Panama	1/3	—	4⅜	— ⅛	7 19 10
Western Telegraph	8	10	15½	—	*6 7 0
HOME RAILS.					
Central London Ord. Assented	4	4	47½	—	8 8 6
Metropolitan	1	1½	19¾	—1	6 8 2
do. District	Nil	Nil	17½	— ½	Nil
Underground Electric Ordinary	Nil	Nil	2	— ½	Nil
do. do. "A"	Nil	Nil	5/-	—2/-	Nil
do. do. Income	5	6	61½	—6½	6 10 1
FOREIGN TRAMS.					
Anglo-Arg. Trams. First Pref.	Nil	Nil	8½	—	—
do. do. 2nd Pref.	—	—	3	— ½	—
do. do. 5 Deb.	6	6	89½	—1	5 8 0
Brazil Tractions	—	—	40	—3	—
Bombay Electric Pref.	6	6	15	—3½	4 0 0
British Columbia Elec. Ry. Pfcs.	5	5	56½	—	8 17 0
do. do. Preferrred	3½	5	59½	+1	9 18 0
do. do. Deferred	Nil	3	44½	+2	6 14 10
do. do. Deb.	4½	4½	58½	—	7 13 2
Mexico Trams 5 per cent. Bonds	Nil	Nil	31½	—4	Nil
do. 6 per cent. Bonds	Nil	Nil	20⅜	—3½	Nil
Mexican Light Common	Nil	Nil	12½	—	Nil
do. Pref.	Nil	Nil	17½	—5	Nil
do. 1st Bonds	Nil	Nil	36	—3	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	—	3	—	*5 0 0
British Aluminium Ord.	10	10	1⅜	— ⅛	9 8 2
British Insulated Ord.	13½	15	14⅛	—	*7 14 8
Callenders	25	—	6¾	—	7 11 6
" 6½ Pref.	6½	6½	4¾	—	6 16 10
Castner-Kellner	20	—	4	—	—
Crompton Ord.	10	—	2/-	—	9 1 10
Edison-Swan, "A"	12	—	1¾	— ⅛	8 17 10
do. do. 5 per cent. Deb.	5	5	70½	—	6 5 9
Electric Construction	10	—	1⅜	—1/9	9 8 2
Gen. Elec. Pref.	6½	6½	13/6	—	7 0 6
do. Ord.	10	—	12	—	*5 14 4
Henley	25	15	9⅜	—	7 1 9
do. 4½ Pref.	4½	4½	5⅛	— ⅛	8 8 7
India-Rubber	10	—	13½	— ½	*7 11 0
Met.-Vickers Pref.	—	8	2⅜	—	6 11 2
Siemens Ord.	18	18	27/6	—	*7 5 6
Telegraph Con.	20	20	34½	—	*4 18 0

* Dividends paid free of Income Tax.

TECHNICAL BOOKS.

By A. C. PURDAY.

The lack of response to a recent letter of mine on the above subject would appear to confirm one of the editorial comments thereon, viz., that many English engineers and students do not appreciate the value of good technical books.

However, a great many of the readers of this journal must find it necessary to purchase books from time to time, and anything that would help them to obtain reliable and useful books at a reasonable outlay should be of interest to them.

The general body of readers of engineering books could probably be classified under three headings, viz. :—

1. Engineering students.
2. Engineering draughtsmen and designers.
3. Installation and maintenance engineers.

For these three classes quite different types of books are needed.

For the first, text-books dealing mainly with the scientific principles underlying the particular branch of engineering dealt with, though not neglecting some indication as to how these principles are practically applied, are required ; for the second class, books in which the principles already understood are put into actual practice in designing machines ; and for the last class, manuals of a practical nature dealing with the problems which arise in the installation, running, and repair of engineering plant.

While it may not be impossible to get books which keep within one of these limits, I think that a great many try to deal with two or all, and in consequence some sections are scrappy and of little practical use.

Again, their titles generally do not adequately disclose the nature of their contents nor the class for which they are written.

This may not be a matter of great importance in London and the larger cities, where a man may go into many book shops, publishers' book rooms, technical Press offices, &c., and look through many books without being compelled to purchase ; but in the smaller towns this is not possible.

Some publishers' catalogues give a synopsis of contents or headings of the chapters, which is a good custom ; but many do not even do this.

There would appear to be still some room for very practical manuals suitable for the third class.

Possibly engineers who are still in practice do not always wish to give their hard-won experience away ; but it appears to the writer that there is a scarcity of British literature (not so much of American) on the practical points which arise in the daily life of the installation and maintenance engineer.

Of course, this is to a large extent supplied by the engineering Press, and the papers read before the engineering institutions and recorded in their journals. The value of the former cannot be too highly rated.

Any engineer who wishes to take an intelligent interest in his profession and to keep abreast of the times, must read the engineering periodicals regularly and thoroughly.

To read only one paper or one branch is not sufficient, I think, and a good plan where there are several engineers or draughtsmen in a works or office is to form a book club, each member subscribing the same amount into a fund, from which the papers are purchased.

It will be found that more interest is taken in the club if there is one periodical per member, and if each member is (as far as possible) allowed to keep the paper he prefers after it has circulated to the other members.

With regard to the papers read before institutions, these, of course, are often most valuable sources of information, the discussions after the reading of the paper forming sometimes the most valuable part.

Where these are not obtained through membership of the particular institution, they can be referred to at the Patent Office Library, London, and at some of the larger public libraries. Good abstracts of most of them also appear in the technical Press.

However, giving all due credit to the Press and institutions, books of a very practical nature, written by men of standing, would, I think, be very welcome in greater numbers than at present, provided always that they were not too dear.

Possibly some saving of cost could be brought about by publishing them in a somewhat similar style to Government publications, *i.e.*, in stiff paper or board covers, and printed on paper not quite so good as that usually used for technical publications.

Perhaps I may be allowed to digress here to remark that there are a number of interesting Government publications dealing with factory plant, &c., which may be obtained for a few pence or a shilling or so from the sales offices of H.M. Stationery Office, or the printers, which are well worth the money expended.

This reminds me that a number of engineering books are issued with fairly full extracts from these Government pamphlets, which seems quite unnecessary. A reference to them should be quite sufficient, as one can obtain the full pamphlet for much less cost than the number of pages it occupies in the book.

To return to the argument, I think it must be the experience of many that every-day factory work lags a good deal behind the state of knowledge and the materials available at the time, and this may be partly due to the want of such practical literature.

There is a very big temptation to put in the *safe* plant, the operation of which the engineer has known for many years, rather than the more efficient, but lesser known, machine that is available.

If, however, it were known, through, say, the medium of recent practical books, that such machines were thoroughly reliable, the careful ones might take heart and gain increased economy (and dividends !) thereby.

I should like to recapitulate the other points mentioned in the letter referred to at the beginning of this article, viz. :—

1. The provision of the date of writing in every edition of the book, so that the purchaser can know whether he is getting an up-to-date book or not. This should also be stated in all catalogues of technical books.

2. The discontinuance of issue (or otherwise complete revision) of books which have become quite out of date.

3. The undesirability (in many cases) of the common practice of beginning a book with the elementary theory, however advanced the main body of the book may be.

4. The possibility of a committee representative of technical institutions, colleges, Press, publishers, and writers, preparing a suitable graded series of standard books on the various branches of engineering, one book of a series leading to another more advanced.

Any remarks on the latter proposal would be welcomed by the writer.

THE EARTHING OF PORTABLE APPARATUS.

By P. R. FRIEDLAENDER.

The fact that cases of more or less serious electric shock in connection with the use of portable apparatus like drills, electric irons, &c., are still occasionally reported, shows that the question of earthing has not yet been completely solved.

The use of three-pin connectors, with the third pin connecting the frame of the apparatus to an earth wire specially run throughout the installation, is a fairly reliable solution if carefully carried out, but is expensive and clumsy, and is, in fact, seldom used.

Since most supply systems to-day are already earthed intentionally at some point (the neutral wire of three-wire supplies, or one main of the ordinary two-wire supply, or the neutral of four-wire three-phase supplies), it seems absurd that an additional special earthing wire should have to be run before a small piece of portable domestic or industrial apparatus can be made entirely shock-proof.

All that should be necessary is to connect the frame of the apparatus directly to the earthed main. This could be effected by modifying the ordinary lampholder (from which so much portable apparatus is still run) in such a way as to give it a unidirectional character, *e.g.*, by making one of the bayonet-cap slots a wide one, and providing the adaptor with a corresponding wide pin on one side.

If then the earthed pole of the installation is always connected to a particular (marked) terminal in the lampholder, and the frame of the portable apparatus is permanently connected to the wire leading to a particular (marked) terminal in the adapter, the apparatus will always be automatically and efficiently earthed when in use. Such a modification of the lampholder need in no way interfere with the use of standard bayonet-cap lamps in it. If screw-cap lamps and adapters are installed, the required unidirectional character is, of course, already present without any modification. In the same way, if the portable apparatus were supplied from a wall plug, it would only be necessary to adopt one of the various forms of non-reversible plugs on the market to attain the same result.

The advantages of such a system would include the important one of making the earthing reliable, as it would practically be under the control of the supply authority, instead of being the haphazard earthing of the individual consumer.

The chief objection seems to be that the neutral wire would be practically converted into an uninsulated return, instead of being earthed only at one point in accordance with the existing Board of Trade regulations, but this rule should not prove an insuperable obstacle, and is, in fact, seldom strictly complied with. Also the difficulty of testing for earth faults on the live mains might be somewhat increased.

NEW AUSTRALIAN TARIFF.

The complete schedule is now available in this country of the new Australian Customs Tariff which was recently introduced into the Commonwealth Parliament. It was published as a supplement to the April 22nd issue of the *Board of Trade Journal*.

It has been known for some time that the revision of the Australian import duties was to be directed mainly towards the protection of existing Australian industries and the encouragement of new ones. The schedule is not final, being under discussion in the Commonwealth Legislature, but it is not likely that any alterations will be passed which do not conform to the underlying principle of the tariff policy, viz., protection.

The items of chief interest to the electrical and allied trades are given below. The new rates under the British preferential tariff are there compared with the old rates. The revised tariff provides also for a general tariff and an intermediate tariff.

	Tariff at Sept. 25, 1918. Per cent.	New tariff. Per cent.
Electrical machines and appliances, electric heating and cooking appliances. Ad. val.	10	30
Electrical fittings consisting wholly or partly of metal, viz., switches, fuses, and lightning arresters. Ad. val.	20	30
Regulating, starting, and controlling apparatus for all electrical purposes, including distributing boards and switchboards, except telephone switchboards and telephone distributing boards Ad. val.	20	30
Dynamo electrical machines, static transformers, and induction coils for all purposes, electrical fans. Ad. val.	25	30
Telephones, telephone switchboards, telephone distributing boards and appliances. Ad. val.	Free	Free
Electroliers, gasoliers, chandeliers, pendants, brackets, zinc tubing, gas stoves, and gas rings.	25	35
Metal filament lamps	20	1s. per lb.
Electrical articles and materials. Arc lamps, covered cable and wire, except cotton covered, electrical vacuum tubes, measuring and recording instruments. Ad. val.	Free	Free
Cable and wire, cotton covered. Ad. val.	Free	25
Carbon manufactures of all kinds, including carbon blocks. Ad. val.	Free	30
Electrical fittings not containing metal to be dutiable according to material not elsewhere indicated, and therefore presumably including batteries and accumulators (other than telephone). Ad. val.	Free	27½
High speed reciprocating steam engines for direct coupling or directly coupled to electrical generators or to pumps, subject to departmental by-laws. Ad. val.	25	27½

On most of the items mentioned the general tariff is 10 per cent. above the British preferential tariff.

It will be noticed that in the case of electric lamps the duty is now placed at 1s. per lb. instead of 20 per cent. Under the general tariff it would be 3s. per lb. This should go some way towards removing the difficulties lately experienced by British lamp manufacturers in competing with the Dutch lamp. It will be remembered that when the import duty was on an "ad valorum" basis, the low cost of the foreign lamp nullified the British preferential rate.

The most ardent protectionist in the Commonwealth is realising that new developments in its manufacturing industries do not depend solely upon the magnitude of the import duty payable upon competing imported manufactures. Additional forms of encouragement will have to be offered to capitalists and manufacturers if they are to be induced to launch out in any big ventures. Some guarantee of more settled labour conditions is essential. Restriction of output and strikes are too prevalent at present. It is true that in spite of such drawbacks, not a little progress has been made in iron and steel production and in the manufacture of numbers of metal products of the simpler forms. There is a fair output, too, of machinery, and quite a lot of assembling plants where locally-made parts are brought together with more complicated imported parts. But what is generally required in any highly-protected industry is a broad and growing home market. And there is room for doubt whether the potential demand in Australia alone for all the manufactured goods which it desires to make within its tariff barrier really justifies any lavish investment of capital in the establishment of artificially protected industries. About the present demand there is no doubt. It would seem preferable, however, in the interests of all, to satisfy it, especially as regards electrical material, by importing United Kingdom goods. This would at any rate make the new tariff a success from the point of view of revenue.

We have received this week the annual report (1919) of the Australian Association of British Manufacturers, and their Representatives. It contains the following reference to the new tariff:—

"It is anticipated that the new Tariff Bill will be introduced to Parliament almost as soon as it reassembles. It is the avowed intention of the Government to grant substantial preference to Australian manufacturers, and with this policy the Association has no fault to find so long as it is carried out in an impartial manner, and without placing prohibitive duties on British manufacturers or irksome duties on goods which cannot be manufactured in the Commonwealth. The Association is, however, not a free-trade organisation, but recognises the wisdom of the protectionist policy of the people of Australia, so long as that policy is not abused. Having granted reasonable and adequate protection to local manufacturers, the Association then looks for reasonable and adequate protection for British goods as against foreign. It must be recognised that the old preferential rates of 5 per cent., or 10 per cent., are no longer sufficient, owing to the enormous increase in the costs of manufacture in the United Kingdom, while the increase of costs in America and Japan are not so high. These countries also have less distance to transport their goods, and consequently lower freights. Therefore, to be of any assistance to the United Kingdom, preferential rates ranging from 20 per cent. to 30 per cent. must be granted to goods of British origin."

Later the report refers to the prohibition of imports thus:—

"Owing to representations received from local manufacturers, the Government issued a proclamation towards the end of last year prohibiting the importation into Australia of certain goods except under licence. Your Association immediately approached the Chief Prices Commissioner, in whose hands the administration of this proclamation was placed, and he assured us that licences would be granted for the importation of reasonable quantities of the prohibited goods. The administration of this office has, however, proved most irksome to traders, as applicants for licences have been required to satisfy the Commissioner with regard to numbers of matters about which it is most difficult for a private trader to obtain information. It is, however, hoped that the Government will see the folly of placing such irksome hindrances in the way of legitimate trade, and will in the near future permit merchants to carry on their business in a normal manner."

"Following on the passing of legislation by the Victorian Government as to the marking of specified goods with the name of the country of origin, the Association has collected a quantity of information from British manufacturers and British associations as to the goods which it is considered should be so marked, and this information has been passed on to the Government. The Governments of the other States have also been approached and urged to pass similar legislation, but up to the present they have not fallen into line."

The Council of the Association reports a considerable increase in membership—the total being 761, as against 623 a year ago; 466 are British manufacturers and 295 are representatives of British manufacturers.

New Irish Industry.—The Electrolytic Copper Co. is negotiating for the purchase of a large part of the ground of what was until recently Kynoch's factory at Arklow, Co. Wicklow, for the purpose of starting a new mineral industry.

THE METROPOLITAN-VICKERS RATEAU PRESSURE-REDUCING STEAM TURBINE.

Where central heating is employed for large buildings the amount of steam required for this purpose might be utilised to great advantage for the generation of electric power.

By generating heating steam at 150 to 250 lb. per sq. in. and passing it through a back-pressure or pressure-reducing turbine before it is exhausted to the heating main, a considerable amount of power may be generated for a small additional expenditure of coal.

Where the whole of the exhaust from the turbine can be utilised irrespective of the load on the generator, a back-pressure turbine is generally installed; but the instances in which this type of turbine can be employed are limited, since it generally happens that the demand for heating steam is irregular and does not coincide with the demand for power. In other words, whereas with a back-pressure turbine there is a direct connection between the amount of steam available for heating purposes and the work which can be done by the turbine, there are other and more numerous schemes of power plant in regard to which the amount of power required and the demand for heating steam bear no relation to each other. A turbine is therefore required which will give either heating steam or electric power independently, and as the demand for either varies. These requirements are met by the pressure-reducing turbine, which consists of a back-pressure turbine and a low-pressure turbine arranged within one casing and having one shaft. The chief merit of this combination is that it possesses the advantages of an ordinary high-pressure turbine, in that low-pressure stages are provided, through which can be economically expanded to condenser pressure, all surplus steam which has not been discharged into the heating mains.

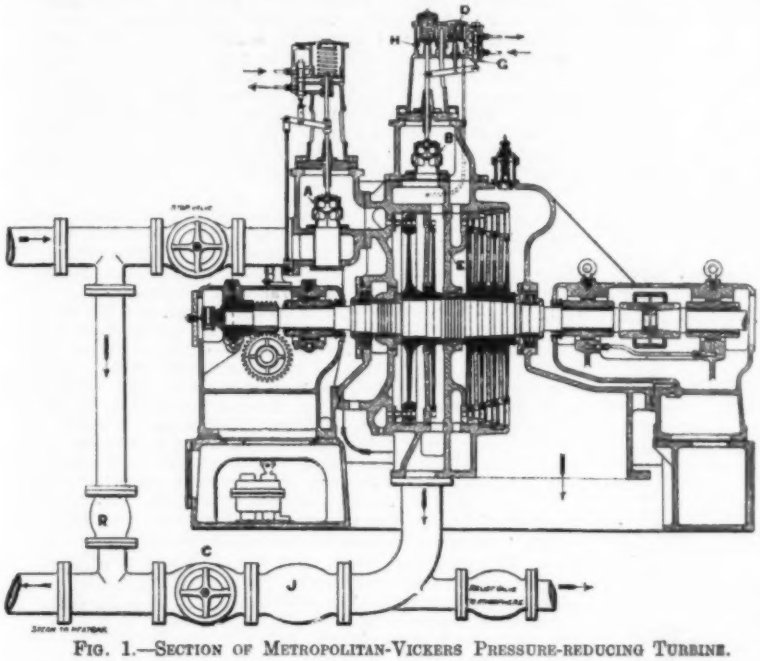


Fig. 1.—Section of Metropolitan-Vickers Pressure-reducing Turbine.

It is of vital importance in some heating processes that there should be no trace of oil in the steam used for heating. This applies particularly to those cases in which the heating steam comes into direct contact with the liquid to be heated. But even if a surface heater is employed, the presence of oil is a serious disadvantage, since it leads to fouling of pipes and heating surface, thereby considerably reducing the efficiency of the heating apparatus.

With a back-pressure engine the difficulties of separating the oil carried over with the exhaust steam are very great, especially where superheated steam is employed.

The best result which can be expected from an oil separator is that the steam leaving the separator will not contain more than 0.35 grain of oil per gallon of condensed steam. Assuming that this result is obtained on an installation where 40,000 lb. of heating steam per hour is required for 3,000 hours per annum, this would mean that in a year some 550 lb. of oil would be carried over to the heating plant.

The steam discharged from a pressure-reducing turbine is entirely free from oil, consequently there are many instances in which a decision must be made in favour of the turbine on this point only, especially as in many cases a pure water supply is of considerable importance for boiler feed purposes.

A typical Metropolitan-Vickers pressure-reducing turbine is shown in diagrammatic form in fig. 1. In this illustration the steam chest and valve gear are shown attached to the top half of the cylinder. This is merely for the sake of facilitating an inspection of their functions. In practice the steam chest and valve gear are placed at the side of the turbine. This arrangement has been found satisfactory for many reasons, for instance:—

1. The mechanism of the governor gear and valve is accessible and convenient from the point of view of operation.

2. The pipe connections are simple and do not form a source of obstruction.

3. With the steam chest and valve mechanism attached to the lower half of the cylinder, there is nothing to interfere with the removal of the top half of the cylinder. It is not necessary to break any pipe joints or dismantle any valve mechanism in order to open up the turbine for inspection.

Considering fig. 1, steam from the high-pressure main, at some pressure usually between 150 and 220 lb. per sq. in. by gauge with a superheat varying from zero to 300 deg., passes through the stop valve and high-pressure governor valve A into a steam belt which feeds the nozzles of the first stage. It then passes through a velocity wheel and a Rateau stage before being discharged at some pressure between 60 lb. per sq. in. by gauge and atmospheric, into the heating main via the non-return valve J and the stop valve C.

When the load on the generator is such as to require more steam than is demanded for heating purposes, a certain quantity of steam is automatically by-passed by valve B to the L.P. portion of the turbine in which it is expanded down to vacuum in the condenser.

The automatic valve B depends for its operation upon variation of steam pressure behind the first Rateau wheel, this variation in steam pressure in turn depending upon variation of load on the generator and adjustment, if any, in the quantity of steam passed to the heating mains. This automatic by-pass valve should maintain the heating steam pressure sensibly constant.

If at any time the amount of steam required for heating exceeds that which corresponds to the load on the generator, the deficit is supplied from the high pressure steam supply through the reducing valve R.

In order to prevent steam from the reducing valve R, or from another set, passing through the heating main into

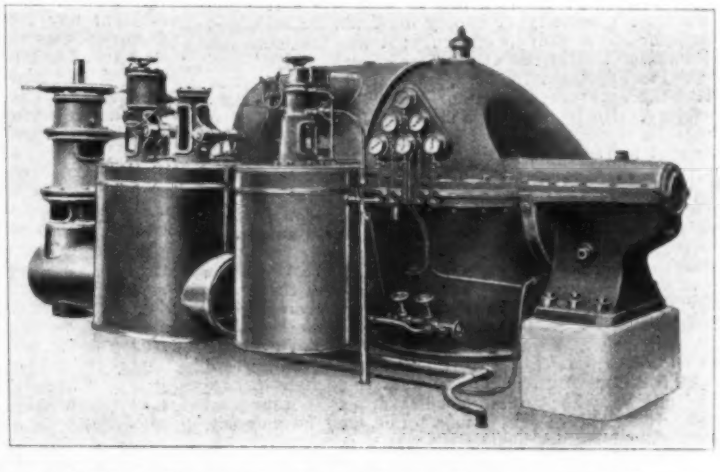


Fig. 2.—2,000-kw. Metropolitan-Vickers Rateau Pressure-reducing Turbine.

the low-pressure end of the turbine and causing the machine to race, a non-return valve J is provided.

As a precaution against any undue increase of pressure being produced in the high-pressure end of the turbine by the automatic by-pass valve sticking in the event of stop valve C being closed, an automatic relief valve is provided on the heating steam outlet from the turbine.

When, with a given electrical load, the demand for heating steam decreases and the supply is throttled at valve C, the pressure behind the first Rateau stage at once increases. This increase in pressure is communicated to the underside of piston D, which is lifted, thereby admitting oil by means of relay G to the underside of piston H, which in turn lifts valve B, thus by-passing surplus steam to the low-pressure stages.

When no heating steam is required, the whole of the steam entering the turbine passes through all the stages into the condenser, and under these conditions the machine operates as an ordinary high-pressure turbine.

PROTECTION OF A.C. SYSTEMS WITHOUT USE OF SPECIAL CONDUCTORS.

At Manchester, on March 23rd, Major K. Edgcumbe's paper on the above subject, an abstract of which appeared in our issue of February 20th, was read and discussed before the North-Western Centre of the Institution of Electrical Engineers.

Mr. H. R. Ratcliffe thought that the various ingenious devices described did not constitute the final solution of this problem; in gear of that description the essential thing was absolute simplicity. The author dealt with feeders and distributors indiscriminately; the line of demarcation between H.T. feeders and distributors was rapidly disappearing, which he thought was unfortunate. From it arose half the necessity for this protective apparatus, half the troubles on systems. At the present time by H.T. systems they meant something between 5,000 and 10,000 volts, but in the majority of cases the actual economic conditions would soon require that those should be regarded as quite moderate pressures. That, again, would be a very good thing, because he thought it would simplify the problem to some extent when pressures were raised, as they would be, to anything between 20,000 and 60,000 volts. New H.T. mains would be laid which they would be able to recognise as feeders pure and simple, and the present H.T. network would distribute only. That would facilitate the separation and isolation of the various compartments of the system and the use of some such devices as the author had described, though in a very modified form. He agreed that pilot leads did not provide the general solution of the problem, but at the present time they provided the simplest and most definite solution—at any rate with regard to such apparatus as was available. Continuity of supply became of very much greater importance with reduced working hours; to be shut down for half an hour was a very big item, therefore continuity of supply must not be sacrificed even for some slight gain in efficiency; it was the more important consideration of the two. With regard to the "simplicity of the apparatus involved," he could not altogether agree that the apparatus the author had described fell within that category. He had quite as much faith in the cable as he had in the protective gear. He thought that much of the time devoted to the protective devices and the expense could be employed in another direction, and the return for the outlay would be just as good as was afforded by the protective gear. With all due respect to manufacturers potential transformers were notoriously the weakest link on a system, and he should not like to think that the safety of the system was dependent upon such a device. It was mainly old systems that required to be linked up and connected, and they were the very systems in which compromise was required. He considered one of the finest forms of cable protection was a test sheet; it had the advantage that it did not wait for the fault to occur, but gave warning that such a fault would arise in the distant future, and one had ample time to cure it before any actual operating troubles arose. With regard to fireclay resistance in the various forms, and he had not, as a rule, found them reliable. He was a great believer in metal, and did not feel the necessity for a resistance having a negative temperature coefficient. A resistance in parallel with the current transformer did not appeal to him; such a transformer was not particularly suitable for operating instruments at any rate. The same amount of protection would be afforded to the transformer, and probably also to other apparatus in circuit, if choke coils or something of that sort were used.

Mr. G. A. Cheetham suggested that the difficulty was not the use of special conductors for protective purposes, but the fact that such systems were evolved at a rather late stage in the development of the art when a large number of transmission schemes were already in existence. The introduction of special conductors was only required for fault discrimination; a perfect system could readily be designed without such conductors, where discrimination was unnecessary. For example, a single feeder was completely protected by "core balance" and overload relays. He agreed that there was considerable danger in disconnecting apparatus too early when that apparatus had not itself developed a fault, but is merely disturbed due to a fault at another portion of the network. He was not in favour of retarding the operation of leakage relays. He failed to see why the addition of fuses in the pilot wires of Merz-Price apparatus slowed down the operation of the apparatus on the occurrence of an earth fault. With reference to the adaptability of protective gear to various portions of a network, he was impressed by the diversity and complexity of recent developments in protective devices taking place in America, where the underlying principle was the differential scheme as outlined by the author. As the system grew the interlocking necessary to provide for the changed conditions occasioned by the tripping of a breaker became complicated. The "watertight" compartment principle of the Merz-Price or Merz-Hunter schemes was here a decided advantage as it enabled a ready step-by-step extension without further complication. He supported the author's opinion that protective-gear connections should be kept entirely separate from the instrument connections.

Mr. J. S. Peck thought that all operating engineers were rather sceptical of the relay. Some of the relays mentioned by the author appeared to be a very great advance on anything which had been done before. That the leakage current could be limited by the amount of resistance in the earth connection was true to a certain extent, but the charging current on the system also had a very great effect upon the amount of current which flowed to earth or the earthed point. When the amount of cable connected to the system was comparatively small it was possible to run with an earth fault for several minutes; but as the amount of cable connected to the system increased the charging current became of very great value, and an earth would develop into a short circuit in a very short period of time. No matter how much resistance was put into the earth connection this very heavy current would always flow to earth. To prevent the risk of fire in the generator in the case of breakdown it was necessary to disconnect it instantaneously.

Mr. Hawkins, an inventor and co-patentee of a protective system which employs special conductors, explained the system for which he held himself responsible to some extent. He and his colleague started with the maxim that a main generating station should not be automatically disconnected except in the event of a fault to earth. By a process of elimination they came down to the Ferranti-field transformer as, in their opinion, the most stable type of protective device. The final idea was to fix a Ferranti-field transformer at each end of the feeder, and connect its secondaries by pilot wires. This system would give the advantages that had been put forward as desirable. In his opinion, pilot wires might in themselves have other and distinct uses, and further uses might arise in the future. Admitting that they might be desirable for such things in the future the addition of a few more was not really a very serious problem. The pilot cable was the only known means of obtaining an instantaneous valuation of the conditions prevailing at each end of the cable at any moment. That the Merz-Price and split-conductor systems worked in watertight compartments, he agreed was an advantage. With regard to rapidity of action, he claimed that the Ferranti-field transformer was one of the most rapid acting gears at present in use. As far as feeder cables were concerned, he agreed that the utmost rapidity of action was desirable. He did not agree that it was the function of time lag to prevent the ill-effects of a fault left on the system. With regard to the author's estimate of the possible magnitude of a fault, the speaker thought that of itself was a clear instance of the desirability of getting the fault off the system as soon as possible.

Mr. Romero, referring to the author's recommendation that the same type of differential reverse relay be used at the generating station end as at the sub-station end of parallel feeders, said it appeared that this would be a very uncertain system of protection, and almost as likely to trip the sound feeder at the generating station end as the faulty feeder.

Mr. H. Williams asked whether the author was satisfied that such close time-lag setting as ¼, ½ and 1½ seconds could be actually obtained in practice? Such tests could not be taken with an ordinary stop watch. He had tested various types of time-lag devices on much coarser settings than those mentioned above, and as a rule the errors were very considerable. In the speaker's opinion every effort should be made to avoid direct-current tripping, especially where batteries were required owing to the large increase in maintenance cost. With regard to the checking of relay settings he agreed that it was most important to check the relays with the current transformers, more particularly in order to ascertain if the ratio error was excessive as a result of the load on the secondary side being too high.

Mr. Ferguson thought that between the scheme put forward for a ring main and the split conductor or Merz-Price

gear, there could be little doubt but that the split conductor or the Merz-Price would be infinitely preferable. A scheme employing overload and reverse relays would be very difficult for the operative engineer. It was all right to set relays with a difference in setting of a quarter of a second, but then account had to be taken of variations in the time for the operation of the oil switches themselves. Furthermore, changes in existing conditions would involve trouble, also extension would necessitate readjustment of all the relays. The Merz-Price and the split-conductor gear were the right forms of protective gear to employ for new systems. With regard to the scheme employing differential reverse relays for duplicate feeders, he thought this gear could be simplified at the generating station end by the employment of the Ferranti-Waters protective gear, which was the same generally in principle, the chief difference being that core balancing was employed. A ring transformer was slipped over each of the duplicate cables at the generating station end; there were two windings on each of these transformers. Two of the windings were opposed to one another, and were connected to two reverse relays, the other two windings being kept in series and were equivalent to the potential windings of the reverse relay. The result was that only two relays were required instead of six. The current transformers were of the ring type, and did not introduce trouble due to defective insulation; the potential transformers were entirely eliminated. For the generating station end, therefore, and double feeders, the Ferranti-Waters gear, which had not been described, was infinitely preferable. It was also applicable to sub-stations where there was an alternative source of supply. If there were three or four feedrs in parallel, or if it was connected up in the form of a ring, the same system was applicable. The tendency now was to eliminate relays as far as possible, and operate directly with the fault current on the oil switch, and thus do away with any necessity for an independent source of supply.

Major K. Edgcumbe, in reply, said that the gear he employed was simple. It was well tried and well understood, and there were no quaint devices about it, no contacts in series or anything of that sort. It was false economy not to spend a few pounds, it might be a matter of only £50 or £100, if one had a large amount of capital in which a much bigger amount of capital was tied up. Potential transformers were liable to break down, but that was not likely to happen just at the moment they were required to trip; if the potential transformers could be connected in star to earth it would be an advantage. He did not recommend a time lag for its own sake, but mentioned one or two incidental advantages of a time lag if it was used for any other reason. In a great many cases, particularly on the smaller systems, a time lag was not such a serious disadvantage, and it had a great many advantages in giving discriminative action. Special conductors unfortunately changed from year to year, so there was no finality about them. He agreed that generator protection should be as instantaneous as possible. If the machine was still doing useful work on the busbars, he did not know that it was necessary to cut it off instantly. He still thought reversal was the criterion, but would not say that definitely. Mr. Hawkins's scheme was very interesting. The Ferranti-field arrangement did not embody a leakage trip and core balance; it was simply a specialised form of transformer which got over the inequality of the action of the various cores on the transformer. Mr. Hawkins's scheme only dealt with leakage trip. If he got a more or less equal fault on it, any fault between phases, it would not trip his gear until it got to earth. It was essential for those who were keen on getting the thing out quickly to try to trip it out before it had got to earth. Some of the old relays did trip on a forward current, which was about twenty times full load. That was due to interaction between the fixed series winding and the fixed pressure winding and the compensating winding, but that had been got over now by putting the motors in parallel and not in series. He could not agree that D.C. tripping was a mistake or that batteries were unsatisfactory. That was the ideal method of tripping, and everybody seemed to be coming to that view now. In the States they were doing the same thing. To trip with the lead current was unsatisfactory, because it varied over such enormously wide limits. His reason for not introducing the Ferranti-Waters scheme as a solution was that it was not quite universal enough. It was perfectly all right at the generator end, but if one was using another relay at the further end it was a mistake to change the type of relay at the generator station end, because one might get a different shape of curve and different times, and so on. It was much better to use the same at both ends. Also the Ferranti-Waters scheme would not do for a cable where one might get reversal.

At Birmingham, on March 17th, Major K. Edgcumbe's paper was read and discussed before the South-Midland Centre of the Institution.

Mr. G. Rogers thought the paper contained a lot that was well known, but there were one or two new features of great interest, particularly the design of the reverse-current relay, which would have many useful applications providing that in practice the characteristics claimed in the paper were satisfactorily obtained. The leakage and overload protection of a feeder seemed to be, where the neutral of the system was earthed through a resistance, an almost ideal arrangement for a single outgoing feeder or for a consumer's supply. The use of fuse-shunted solenoid protection for a simple circuit in which a discriminating time lag was not required was not only the simplest method available, but was perfectly satisfactory in operation. Air dash-pots were not always satisfactory, and where the fuse-shunted solenoid could not be used the induction pattern inverse time limit overload relay with separately adjustable current and inverse time settings was the most satisfactory device to adopt. With reference to the split conductor system, it would not be advisable to rely entirely on the split conductor relay. Overload relays should be put in circuit at both ends of the feeder if it was possible for current to pass through the feeder from either end. This provided a complete system of protection, which was equally as good as the combined leakage and overload relay suggested by the author. The suggestion for the protection of parallel feeders with differential reverse relays was interesting, but since there was always the danger of an unbalanced load on the feeders, this method was not likely to have a very wide application. The author's suggestions for the protection of a ring main system was interesting, but, since the reverse power relays on the inter-connector cable between the two sub-stations might be called upon, in the event of one of the feeders from the generating station being tripped out due to a fault, to carry the full load current to the sub-station, it would be necessary for the setting of the reverse power relay to be very high. It was not clear, therefore, where the advantage of the reverse power relay came in over an overload relay which would operate with current flowing in either direction.

Mr. W. Wilson supported the use of suitable shunt fuses for affording a time-limit to trip coils, in spite of the author's condemnation of these as being capricious in their action. A fuse-wire supported in such a manner that it did not touch its supports except at its extremities, and composed of a metal that did not expand sufficiently to permit sagging against the walls of the glass tube in which the switchboard fuses were generally contained, would give a time curve of surprising regularity. It was, however, true that the operation of a fuse depended on other circumstances than the magnitude of the overload. Conductors would come to grief sooner when they were heated than when they were cool, and the fuse, by also blowing more readily when hot, afforded sound protection when an electromagnetic device would fail. The solenoid and dash-pot pattern only gave an approximate protection, for the plunger did not begin to move until the actual overload had occurred, irrespective of the state of the cables, &c. when the overload had come on. The thermal relay (or thermal breaker) would give the same protection as the fuse, in that it would represent the conductor in its behaviour, and its condition would vary just as that of the circuit did; it was much simpler, and was less susceptible to faulty use. At the same time, both fuses and circuit breakers gave excellent adjustment, the former by the alteration of the gauge of wire, and the latter by the adjustment of the sag of the resistance strip.

Mr. R. G. Jakeman said, with regard to single interconnectors, that if the fault occurred when the interconnector was lightly loaded, the full overload current must flow into the fault before the relays would act. The author stated that the circulating currents between two machines in parallel due to hunting were very much out of phase with the voltage. Actually, however, these currents were practically in phase with the voltage, since they represented the synchronising power, which was the power tending to pull the machines back into their correct relative positions.

Dr. G. Kapp thought that engineers would be pleased to learn that protection could be obtained without the use of pilot wires. Their utility became doubtful when, on account of subsidences in the ground there was a chance of pilot wires being broken without the staff at the power house knowing it. The author's method had, further, the merit of simplicity. It did not, however, touch the protection of machines from the heavy blow which the winding received in the first moment of an explosive short circuit. To a certain extent this was also the case with regard to heavy feeders. When the grading of time lag in the different parts of the distributing plant had to be done to the fraction of a second, it could not be very definite. If it were possible to permit a somewhat longer time all round the grading could be made more definite, and less delicate relays, not liable to act prematurely, might be employed. This meant giving up the use of circuit breakers in order to save machines or circuits from the first rush of a short circuit current, and adopt for this purpose the well-known method of added inductance. This meant that they must lower the power factor of the whole system to such a value that economical working became impossible. But there was a remedy. If they installed at the delivery end of the lines apparatus to inject leading K.V.A. they again raised the power factor, and it was this policy which seemed to solve the problem of something very near absolute protection. At a first glance the proposition might seem paradoxical, incurring additional expense without improving the general condition as regards protection, but this reasoning would be fallacious. If they recognised that only

the P.F. at, say, from ¾ load upwards mattered, they might employ a cheaper source of leading K.V.A. than either condensers or synchronous machines, namely, any type of phase advancer fitted to individual motors. If the consumer used small motors or even large squirrel-cage motors static condensers were the only possible means of his obtaining in his own plant a good P.F. If he had large slip-ring motors he could use a phase advancer, and although his P.F. at light loads would not be so good as with condensers, his P.F. at full load or overload would be in the neighbourhood of unity, and that was all the supply company could reasonably demand in return for the concession in a tariff specially designed to induce customers to counterbalance the lowering of the P.F. due to the employment of inductances for protection of their plant.

Mr. W. Brew said, with regard to the leakage transformer, that special precautions would be advisable either in the design or location of this transformer to shield it from stray magnetic fields such as might be set up by violent disturbances upon neighbouring circuits. In connection with the protection of parallel feeders, he hardly thought the method suggested could be regarded as a general solution of the problem. With two parallel feeders of equal lengths and sections, but differing appreciably with regard to inductance and capacity respectively, it was obvious that the larger share of the load would pass from one cable to the other and *vice versa* according as the power factor was leading or lagging. In the case of short heavy current single cables also the current distribution might be seriously upset if the areas enclosed by each pair of cables forming flow and return were unequal. The magnitude of the triple frequency current loss assumed was, he thought, larger than was likely to be experienced with modern plant. Even were it much less, however, the annual loss capitalised should in the case of large generating units fully justify the adoption of efficient means to eliminate it. These triple frequency losses were not easily measured with accuracy, but if a generator could be run as a synchronous motor the difference between the two sets of watt-meter readings would give the loss. The power required to drive the motor measured by the two watt-meter method did not include the triple frequency loss, whilst the power measured under the same conditions by the three watt-meter method with pressure coils connected to neutral point did include it. He strongly urged that the most important feature of a relay-control system should be its power to indicate clearly when, and where, a fault had occurred. Under the mental stress of an emergency apparently logical conclusions might be quite misleading, and this was especially likely to be the case where the seemingly erratic action of a number of instruments and circuits had to be interpreted. A good deal of expensive apparatus had been installed and "tied up" in the past on this score alone.

Mr. A. T. Thurman said the arrangement for the protection of a system comprising two generating stations and four sub-stations was all right providing the interconnector between the generating stations was large enough to transfer load from one to the other, in case of trouble at either station. With regard to the checking of relay settings, the initial test after the relay had been installed in its working position should be from the primary side of the current transformer. This method tested the current transformer, relay and wiring, practically under working conditions.

Mr. J. Morton referring to the use of reverse relays for the protection of generators, and that only an independent supply for the pressure element of the instrument would give any sense of security, said that such an independent supply might easily be obtained by installing a unity ratio potential transformer across a reactance, the voltage obtainable being governed by the current flowing in the reactor, and, further, under faulty conditions the normal current might be increased many times, thereby giving a proportionate increase in the pressure across the terminals of the potential transformer with a resultant increase in power for the satisfactory operation of the relays. It seemed to him that some advantage might be gained by putting half the total reactance in the machine itself, and the other half external to the machine. With this arrangement there would be no difficulty in providing the independent supply suggested for the relay potential coils, but it might be necessary to install some apparatus for the purpose of cutting the unity ratio potential transformer out of circuit at some pre-determined pressure limit, say, 400 volts, for in the event of the reactor being called upon to perform the function for which it was primarily installed, the voltage across its terminals would rise to any figure between zero and full phase volts.

Mr. W. E. Groves said the four cardinal points mentioned at the commencement of the paper required a limitation of the number of protective devices employed. These considerations made the layout described more applicable to undertakings of moderate size than to large systems. With an unearthed neutral a fault on one phase only might hang on for a considerable time, ultimately developing a complementary fault on another phase and on an entirely independent line. These faults between phases simultaneously pulling two lines out of commission might occur at a very inconvenient time, and it was not possible to quickly locate a single-phase fault without resorting to earthing. A weak spot, which would not stand the extra strain imposed by the original fault, was better disclosed, but not when one was occupied with another breakdown. The Merz-Price system could be extended to cover any mains or gear, but it introduced complexity. In connection with closed ring mains, the speaker devised an adaptation of Merz-Price protection to cover a complete consumer's sub-station, and the adjacent length of main. In order to reduce the amount of apparatus overlapping current transformers were proposed, but even this modification did not make the scheme worth pursuing, and events had proved that it would not have been justified. For mains laid under favourable conditions it was illogical to protect cables and leave the more vulnerable switchgear unprotected.

AUTOMATIC ELECTRIC WEIGHING MACHINES AS USED WITH MACHINE PACKERS.

By VICTOR SIMS.

(*Abstract of a lecture delivered at the* Junior Institution of Engineers.)

Automatic weighing machines comprise a large and varied field of mechanical ingenuity. Automatic electric weighing machines, as used with machine packers, are adapted for weighing granular and other substances. To appreciate fully the functions of the weighing machines it will be well to outline the process in which they play a part, in this case the conversion of the 1-cwt. chests of tea as imported, into the familiar packets. From the chests, the tea passes through a mill or grinder which is furnished with magnets for extracting nails, and an arrangement of inclined sieves by means of which pieces of paper, wood, &c., are separated from the tea. After this it is blended in revolving drums, and transferred in sacks to hoppers which feed the weighing machines. These weighers are situated over packing machines in conjunction with which they work.

The packing machines cut from a roll of paper, fold into a bag, and at the right instant the weighers drop a weighed quantity of tea, the bag is then folded at the top and pushed out along a slide. The rows of packets are next put by hand on trays, and the trays on trolleys. The folded ends of the packets are then sealed by sticking labels round them; this may also be done by machinery.

There are two types of packers, the principles being somewhat similar, but the mechanical details vary. One type is by Job Day & Sons, the other by Rose Bros. The "Rose" type may be fairly considered the more modern machine, as the design is such that it may safely be worked at double the speed of the "Day." The latter is furnished with a single funnel fed by two weighers, while the former has twin funnels fed by four weighers.

All types of weighers are operated by receiving an impulse from the timing switch. This starts a cycle of operations which consists of the release of a weighed quantity, followed by the weighing of another in readiness for the next impulse. By this means, any variation in speed of weighing occurs at the end of the cycle, and this necessitates means to prevent another cycle starting, if a previous quantity is not fully weighed.

To obtain accurate weighing, the substance should be fed on a beam in a fine stream when nearly balanced, but in many cases this would take too long to fill, so means are provided to perform the weighing in two or more operations. The methods of doing this vary in the different machines, but speaking generally one type operates by dropping a certain measure, and completes the weighing by means of a fine dribble. The other type weighs both quantities on beams, and a very excellent machine weighs any one quantity on four consecutive beams, attaining its full weight on the fourth.

One type of "Southall & Smith" machine, the simplest of which type has a single beam and performs the weighing in one operation, consists essentially of a box-type frame which contains the beam and a cam shaft. The pan consists of a receptacle, the bottom of which is closed by a hinged counterbalanced lid, which is normally held tight by a small electro-magnet. Behind the feed box is a slide, magnet, and contacts, which constitute what may be called the "cut-off" mechanism. On the side of the machine is another magnet, armature, slide, and clutch, so arranged that when the circuit is closed through the timing switch and magnet, the

slide is released and the clutch operates, driving the cam shaft one revolution. During this single revolution, which may occupy one second or more, the following operations are executed. The circuit of the pan magnet is momentarily broken, releasing the previously weighed quantity. The slide behind the feed box is moved by cam and bell crank lever up to the magnet, which retains it against the tension of a spring. This opens a narrow channel from the feed box, which contains a revolving star wheel, ensuring a continuous and even feed. The feed continues till the beam is turned, the rear end rising and breaking the circuit of the magnet retaining the slide, which flies back, cutting off the feed.

The machines for weighing larger quantities have the addition of a "bulk feed." This is obtained by dividing the feed box into two portions. The fine feed is retained as described above, but the capacity of the other portion can be adjusted by means of a screw and movable plate. A cam is timed to depress the rear of the beam when the feeds open, to prevent bouncing, afterwards rising to permit free motion. For the smaller quantities, the measures are merely opened at the bottom during a brief interval. In the larger machines a slide cuts off above, before opening below. In a later type, this first quantity is weighed on a beam against the tension of a spring. The clutch for the fine feed is controlled by the slide which performs the "cut off." The other is operated by a magnet in circuit with a contact, which is closed when the primary weighing is complete. In this position the clutch is free, *i.e.*, feed is stopped. In operation, the contents of the first beam are dropped into the second, which has just released its own contents. Directly the first beam is thus lightened, contact is broken, a spring releases the trigger, which causes the clutch to engage and drive the feed till contact is again made. On all those types of "Southall" machines a contact in series with the side magnet is arranged to be broken while the fine feed is open. This prevents premature release of an incomplete weight.

The construction of an early type of "Driver" machine is somewhat different. Two machines are built together, constituting a twin or duplex weigher, but each may be considered as a separate unit. The clutches are released by magnets and plunger stops. The clutch for driving the fine feed is also released by a magnet which is interconnected with a relay on top of the machine. In operation, the central traverse cam shaft is rotated for one revolution, in consequence of the magnet in series with the timing switch releasing the clutch. This shaft mechanically opens and closes the pan, and electrically starts the second shaft, which simultaneously closes two contacts for a brief period, and operates the bulk feed by closing the measure at the top, opening at the bottom, returning to its original position by closing the bottom, and opening again at the top. One of the contacts is for energising a magnetic beam lock; the other starts the fine feed by releasing the clutch. When weighing is complete, the beam falls and energises the relay which breaks the circuit of the magnet for the fine feed clutch, thereby arresting its motion. Premature release is guarded against by connecting the beam contacts in series with the magnet which releases the first clutch. Thus, the beam must be down before another operation can be started.

The later type of "Driver" machine is an excellent design; being far less complicated than any other, and if adjusted correctly is quite as accurate. Weighing is performed on two consecutive beams, except for the smallest quantities. A friction clutch, when released, drives a cam shaft one revolution, opening the two pans mechanically; the full weight dropping down the funnel, and the half weight dropping into the next pan as soon as it is closed. The two beams are fed from a single trunk by means of roller feeds driven by magnetically released friction clutches. The magnets, in circuit with contacts on their respective beams, release the clutches till the beams are turned. To diminish bouncing, these are compounded. The cams are also contoured to steady them after opening the pans. A contact, broken by the magnet when the fine feed is running, prevents premature release.

The best machine from a mechanical point of view is the "Popoff." Here the weighing is performed on four consecutive beams. Essentially, it consists of four beam units arranged under a table which is capable of intermittent partial rotation. The table has five equally spaced circular excisions, which loosely support an equal number of light spun aluminium cups. In operation, a magnet in circuit with the timing switch, releases the one-revolution clutch. The table lifts the cups off the beams, shoots round one-fifth of a revolution, and lowers them on to their next. The fifth cup, which has already attained its full weight, is then tipped. As each cup attains its weight, the beam falls and completes the circuit through the magnet, drawing down the armature, releasing the lever, thereby stopping the corresponding feed by withdrawing the clutch. The levers in falling open the circuits by means of spring contacts, thus saving energy, also taking the inductive break instead of the relatively delicate beam contacts. A fifth spring contact is in series with the magnet which releases the one-revolution clutch, and constitutes the means for ensuring that all weighing operations are complete before being repeated.

Having now briefly described the various machines, I will indicate the manner in which they are generally arranged with regard to the packer. The "Day" packer, making about 30 bags a minute, is fed by two weighers, which are usually built right and left hand constituting a "duplex" weigher. In this case the funnels unite and feed through a single one on the packer. The "Rose," making about 60 a minute, is fed by two twin or duplex weighers forming a "quad set." "Southall" machines are arranged 1, 2, 3, 4, operating 1 and 2, then 3 and 4; 1 and 3, 2 and 4 funnels unit into two oscillating ones on the packer, filling two bags at a time. By arranging one wide funnel under each twin, and wiring so as to operate 1, 3, 2, 4, instead of 1, 2, 3, 4, a more simple funnel arrangement is obtained. "Driver" quads are arranged in this manner. The speeds of both type of packers can be varied within limits; the actual speed is governed by the best average speed of the weighers working in conjunction. Small quantities can be weighed faster than larger.

Timing and Bag Switches.—The former are operated by cam shafts on the packers, for making contact to start the weighers. The latter are operated by the pressure of the bags when they are about to be filled; if these are absent, the corresponding circuits are opened. A tumbler switch is also included in circuit on each packer, which should be switched off when the packer is stopped, otherwise if it happens to stop with the timing switch closed and a bag pressing against the bag switch, the weighers continue to operate, filling the funnel. The timing switch consists of a cam revolved, on a "Day" packer, at half the speed of the packer, making contact for each weigher at every alternate half revolution. It is set to make contact when the bag is pressing the bag switch, just before it is moved under the funnel.

For a quad, the cam revolves at a quarter of the speed of the packer, making two simultaneous contacts at every half revolution. Timing may be adjusted by bodily revolving the frame of the switch, thus altering its position in relation to the cam. All weighers require contact to be made a short period before the funnel is over the bag to be filled, as a brief interval must be allowed to enable the weighers to start their cycle of operations, and for the substance to fall through the funnel. For a quad set, therefore, contact is made when the funnels are just rising, preparatory to moving backwards and descending on to two fresh bags, which were at that time pressing their respective bag switches.

Accuracy.—It is quite possible with a uniform degree of granulation, to set these machines to weigh accurately to a very small fraction of a dram. It is obvious, however, that a true balance is never obtained on the beams; the inertia of the beam, the degree of rapidity of cut off, and the impact of the running feed all affect the weighing. The first and second of these factors, for a given machine, are practically constant, but the third varies with the degree of granulation of the substance being weighed. A fine substance feeds at a higher speed than a coarse, making a greater impact on the beam. In the machines with bulk feed also, the measures would hold a greater weight for the same capacity. With the usual blends of tea, the granulation is such that four ounces occupy between 325 and 375 cu. cm. of free space. In this case, the best speed of the weighers allows the packers to be driven at the speeds already mentioned, which allows about four seconds for each complete cycle. It is best to adjust the measures so that weighing is as slow as the packer will allow, and then adjust the jockey weight on the beam to obtain accurate weight. As mixing is seldom quite thorough it is not considered advisable to constantly alter the jockey or measures for the greatest accuracy. If the measures are set too "close," missing is liable to occur; and if the jockey is altered to obtain greater accuracy one minute, it may be necessary to replace it soon after. If a coarse blend is substituted for a fine one, attention is generally drawn by the weighers missing, but if the reverse occurs weighing is usually too fast, resulting in varying degrees of overweight. Machines with roller feeds may be finally adjusted by varying the aperture between the feed roller and plate by means of screws, instead of the jockey.

The mechanical power absorbed in any of the machines described is relatively very small. The electrical energy required varies according to type, but is not a great amount. The usual pressure is 110 volts. The "Popoff" machine probably takes the least quantity of energy, as current flows in any of the five parallel circuits only momentarily; while current is flowing continuously in certain circuits of the "Southall" machine, only being interrupted during operation, resistances are, therefore, placed in series to limit the current.

Upon consideration, the effect of varying degrees of granulation on accuracy of weighing does not appear to depend solely on the altered impact on the beam, but also on that quantity which passes during the brief operation of "cut off." As before mentioned, a fine substance passes through the feeds at a higher rate than a coarse. The effect of the greater impact on the beam, alone, would appear to cause the beam to be turned slightly early, resulting in a light weight, but experience shows that the reverse is the case, viz., other things being equal, a fine substance will weigh heavy compared with a coarse.

It should be noted that the term "degree of granulation" used to define fine or coarse substances, does not necessarily imply a definite uniform size of the grains, but uniform pro-

portions of the various sizes throughout any particular blend. Thorough mixing will generally ensure this.

Having regard to the widely varying conditions met with in practice, it would be difficult to give definite figures relating to accuracy, but within the limits of the author's experience it has been found possible to set any of the machines to weigh a uniform suitable blend, such that inaccuracies could barely be detected on balances sensitive to about 1 grain. But any change of blend involving a different degree of granulation would cause an error. In extreme cases this may amount to as much as half a dram, but this is soon detected and remedied. The only type of machine described which is not liable to inaccuracy on this account is the "Popoff," due to the extremely fine final feed, notwithstanding the speed of the machine being twice that of any of the other types. Mechanical imperfections and the liability of the feeds to get choked more or less, by pieces of paper, wood, and nails, however, demand constant vigilance and checking of any machines in operation.

I have said sufficient to outline the methods adopted for rapidly weighing small quantities of granular substances. I have had no experience in dealing with finer substances, such as powders, or coarser ones, such as certain cereals, but if I have managed to convey in an intelligible manner some idea of a few of the principles involved, I shall feel amply rewarded for the preparation of these notes.

NEW PATENTS APPLIED FOR, 1920.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

10,116. "Apparatus for manufacture of electrodes." Metrodes, Ltd. April 12th.

10,168. "Telephone systems." Western Electric Co. April 12th. (United States, April 11th, 1919.)

10,181. "Production of high-tension unidirectional currents or impulses." H. B. Mackenzie. April 12th.

10,184. "Thermo-electric systems for production of electrical energy." E. B. Potter. April 12th.

10,194. "Control of electric ignition systems of internal-combustion engines." R. M. Balston. April 12th.

10,204. "Radio-telegraphy signalling systems." W. J. Mellersh-Jackson (A. Taylor). April 12th.

10,216. "Telephonic apparatus permitting of automatic calling and connecting up." L. Turcat. April 13th. (France, March 6th, 1919.)

10,217. "Automatic telephony." L. Turcat. April 12th. (France, April 10th, 1919.)

10,232. "Electric circuit breakers, &c." R. A. R. Bolton. April 13th.

10,241. "Continuous-current voltage reducer cells." J. W. Goodman. April 13th.

10,248. "Terminal connections for flexible electrical conduits." F. A. Griffin. April 13th.

10,253. "Rotary electric transformers and converters." Accles & Shelvoke and H. F. L. Steventon. April 13th.

10,258. "Automatic telephone, &c., systems." A. Lamboy. April 13th.

10,263. "Electric changing-colour sign." F. E. Ewer, Ewtill Manufacturing Co. and P. A. Tillinghast. April 13th.

10,293. "Electric rotating furnaces." C. E. Cornelius. April 13th.

10,299. "Electric muffle furnaces." Automatic & Electric Furnaces, Ltd., E. P. Barfield and L. W. Wild. April 13th.

10,300. "Electric clocks." F. T. Reid. April 13th.

10,319. "Controlling resistances for electric circuits." Igranic Electric Co. (Cutler Hammer Manufacturing Co.) April 13th.

10,363. "Dynamo-electric machines." E. G. Barter. April 14th.

10,365. "Sparking plug." C. S. Harrison. April 14th.

10,373. "Distributing arrangements for telephone, &c., systems." Automatic Telephone Manufacturing Co., R. Mercer and J. Savin. April 14th.

10,374. "Call-indicators for telephone systems." Automatic Telephone Manufacturing Co. and S. R. Smith. April 14th.

10,402. "Wireless telegraphy." F. O. Reid and H. Scott-Taggart. April 14th.

10,404. "Multiplex high-frequency electrical signalling systems." Western Electric Co. April 14th.

10,405. "Electric burglar-alarm systems." G. G. Portch. April 24th.

10,417. "Device for holding telephone receiver when in use." J. E. Saunders. April 14th.

10,466. "Transmission and distributing with alternating currents." A. M. Taylor. April 15th.

10,477. "Mounting electric motors on machines." W. Asquith, Ltd., and G. Feather. April 15th.

10,490. "Means for electrically indicating vacant seats in theatres, &c." F. H. Austin and R. Robertson. April 15th.

10,512. "Electric telephones." H. P. Rees. April 15th.

10,534. "Electric motor control." British Thomson-Houston Co. and N. Shuttleworth. April 15th.

10,539. "Thermo-electric measurement of temperature." Cambridge & Paul Instrument Co. and F. Rowcliffe. April 15th.

10,542. "Electric gas-ignition devices." J. O. Delen. April 15th

10,549. "High-frequency electric signalling." Western Electric Co. April 15th. (United States, August 21st, 1915.)

10,551. "Wireless telephone transmitters." A. R. Taylor. April 15th.

10,552. "Induction or reactance coils." A. R. Taylor. April 15th.

10,553. "Electric cables." W. P. Granville and W. S. Smith. April 15th.

10,561. "Electrolytic method, apparatus and product." M. M. Merritt. April 15th. (United States, April 15th, 1919.)

10,566. "Overhead electrical conductors, cables, &c." A. Watts. April 15th.

10,612. "Spark plugs." R. R. Hill. April 16th. (United States, April 5th, 1916.)

10,620. "Electric gongs and hammers." C. H. Newton. April 16th.

10,631. "Portable magneto lamp." J. Lowe, S. B. Palmer and N. V. Pearson. April 16th.

10,644. "High-frequency dynamo-electric machines." British Thomson-Houston Co. April 16th. (United States, June 22nd, 1915.)

10,646. "Electric lamps." W. R. Bullimore. April 16th.

10,647. "Device for testing sparking plugs." G. Burchell. April 16th.

10,654. "Field pole-pieces for electric machines." H. de La Valette. April 16th. (France, April 16th, 1919.)

10,661. "Electric relays." M. D. Dimitrievitch. April 16th.

10,666. "Devices for protecting telephone, telegraph, &c., instruments against lightning or excessive electric potentials." A. E. Beattie. April 16th.

10,669. "Telephones." G. B. Bilet and C. Kearton. April 16th.

10,690. "Electrolysis needle for face treatment." H. O. Bremner and Mrs. Manning. April 17th.

10,701. "Locking device for switches of direct-current electric motors." G. G. Addison. April 17th.

10,702. "Device for testing sparking plugs." G. T. Waite. April 17th.

10,707. "Electrical means for indicating relative movements of members of apparatus." W. H. Eccles. April 17th.

10,718. "Winding for electrical apparatus." G. Schroder. April 17th.

10,719. "Insulated electric conductor." G. Schroeder. April 17th.

10,748. "Methods of preventing injurious earthing-currents in electrical nets." Akt. Ges. Brown, Boveri et Cie. April 17th. (Switzerland, April 17th, 1919.)

10,754. "Multi-pole junction box." M. J. Railing and W. Saunders. April 17th.

10,760. "Sparking plugs." K. E. L. Guinness. April 17th.

10,763. "Brush-gear for dynamo-electric machines." East Anglian Engineering Co. and H. C. Waters. April 17th.

10,772. "Electric insulators." R. Cox. April 17th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

16,350. Regulating mechanism for controlling speed of induction motors. British Thomson-Houston Co. (General Electric Co.). November 13th, 1916. (140,476.)

1918.

18,683. Arrangement of several electric generating groups for the purpose of supplying an equal number of electric motor groups. H. Crochat. November 14th, 1917. (140,491.)

18,689. Method of electric arc welding, cutting and repairing. C. J. Holslag. April 20th, 1918. (136,271.)

19,388. Electric accumulator plates. C. P. Elicson. November 25th, 1918. (140,500.)

20,209. Lamp telephone relays. M. Latour. December 5th, 1917. (140,506.)

21,679. Magneto-electric machines. R. B. North and A. M. Allen. December 24th, 1918. (140,518.)

21,680. Magneto-electric machines. R. B. North and A. M. Allen. December 24th, 1918. (140,519.)

21,681. Interrupter devices for magneto-electric machines. R. B. North and A. M. Allen. December 24th, 1918. (140,520.)

1919.

33. Electric generating arrangements for vehicles. C. L. Kirk. January 2nd, 1919. (140,525.)

291. Control of hydro-electric power stations. R. J. Wilson. January 4th, 1919. (140,528.)

1,255. Electrical switches. R. B. Benjamin and A. N. Nilson. May 4th, 1918. (126,607.)

1,273. Wireless transmission. C. S. Franklin. January 17th, 1919. (140,538.)

3,136. Starting and synchronising of synchronous dynamo-electric machines. R. E. Grime and Mather & Platt. February 8th, 1919. (140,554.)

4,116. Intercommunication telephone system. L. C. Bygrave. February 19th, 1919. (140,561.)

4,382. Electrolytic cell. J. Harris. February 21st, 1919. (140,563.)

4,848. Electrodes and welding and like rods used in soldering and depositing metals. E. H. Jones and Alloy Welding Processes, Ltd. February 26th, 1919. (140,568.)

6,124. Electric lamps for cycles and the like. M. H. Goldstone and H. O. Farrell. March 12th, 1919. (140,582.)

6,595. Electric terminal. J. Chatwin (A. & O. Christ, Sons & Co.). March 17th, 1919. (Convention date not granted.) (124,729.)

8,924. Electric switches. R. K. Damey and C. A. Damey. April 8th, 1919. (140,607.)

10,336. High-tension magnetos. J. H. Runbaken. April 25th, 1919. (140,629.)

13,007. Automatic or semi-automatic telephone systems. Automatic Telephone Manufacturing Co. and A. J. Ray. May 23rd, 1919. (140,653.)

13,666. Electric coils. B. Ames and P. J. Gilinson. May 28th, 1919. (140,661.)

16,268. Composition for insulating and waterproofing electrical elements. G. Tucker. June 28th, 1919. (140,675.)

21,089. Dynamo-electric machines. Baron Clifford of Chudleigh. (W. H. Clifford). August 27th, 1919. (140,693.)

23,073. Electric induction coils for medical purposes. M. H. Goldstone. September 19th, 1919. (140,705.)

26,014. Electrical means for facilitating navigation on predetermined courses. Siemens & Halske Akt. Ges. July 11th, 1918. (134,226.)

31,199. Apparatus for electrically controlling railway trains or vehicles through the track. A. R. Angus. October 10th, 1917. (Divided application on 15,863/18.) (136,570.)

31,200. Apparatus for electrically controlling railway trains or vehicles through the track. A. R. Angus. October 10th, 1917. (Divided application on 15,863/18). (136,571.)

32,392. Sparking plugs. E. F. Burrill, S. E. Grubb and T. E. Nankivell. December 24th, 1919. (140,733.)

E.D.A. Activities.—The latest piece of propaganda issued by the E.D.A. is a poster (E.D.A. 73, 28 in. by 18 in.), "Electric Cookery saves Food and Fuel," depicting a young lady attending to an electric cooker. It is attractively printed in several colours, with a space at the bottom for the insertion of the contractor's name and address.